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THE BRITISH JOURNAL
OF
OPHTHALMOLOGY

APRIL, 1920

COMMUNICATIONS

THE INFLUENCE OF PROLONGED MONOCULAR OCCLUSION IN REVEALING ERRORS OF THE MUSCLE BALANCE.

BY

F. W. MARLOW, M.D., M.R.C.S.Eng., F.A.C.S.,

PROFESSOR OF OPHTHALMOLOGY IN THE UNIVERSITY OF SYRACUSE, N.Y.

NEITHER in text-books of ophthalmology nor in monographs upon anomalies of the ocular muscles is any reference made to, much less is any emphasis laid upon, the importance of the duration of the tests of heterophoria. I recall only two brief references to it in the literature of the subject. As I have been unable to find the original papers I can only state from memory that one, by a London ophthalmologist, dealt with the effect of holding the screen for a definite period, ten seconds, I think, before the eyes before shifting it, instead of momentarily; and the other by Posey, of Philadelphia, who drew attention to the advantage of taking the trouble not to remove the screen from the covered eye at the end of the refraction tests before placing in front of the uncovered eye a Maddox rod or whatever device was to be used for testing the muscle balance, thus taking advantage of the relaxation which might have occurred during the tests for refraction. But a little consideration of facts of common clinical observation, namely, that a squint is very apt to

develop in children, the subject of any condition, such as ulceration of the cornea, temporarily annulling binocular vision, that it develops not infrequently in patients who have had one eye bandaged for any length of time, and that a divergence or other deviation develops after a longer or shorter period in eyes which have become blind or very defective from any cause would lead to the inference that the duration of annulment of the binocular function is a very important factor in the detection of faults of muscle balance.

Another common clinical observation—which makes the fore-

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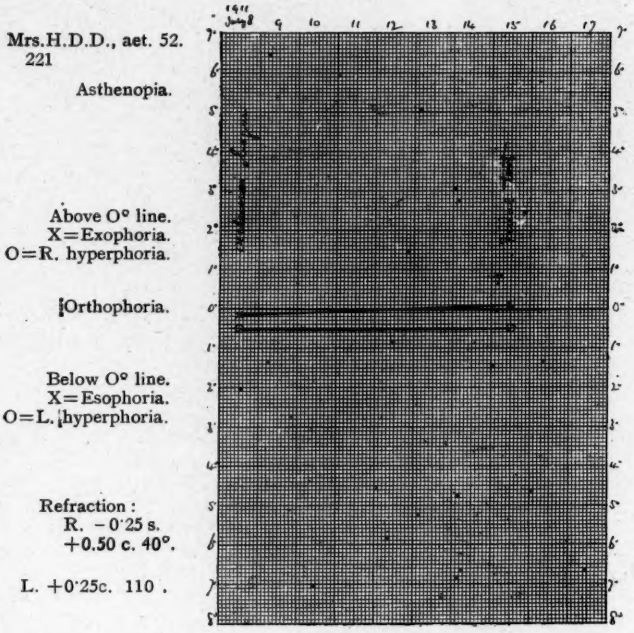


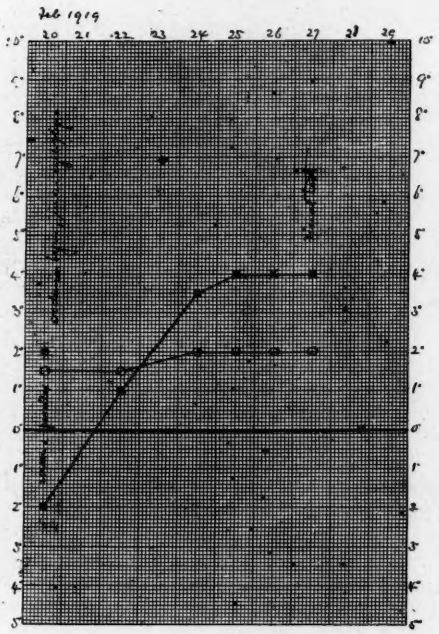
going inference of practical importance—is that there are a great many patients, the character of whose symptoms leaves no doubt that they are the subjects of some kind of eye-strain, who fail more or less completely to receive benefit from an apparently accurate correction of their manifest refractive and muscle errors, or are made worse by such correction. I wish to submit that in a large number of these cases the failure to relieve is due to the inefficient manner in which the tests for muscle imbalance are made, in respect merely of the length of time for which the binocular function is annulled.

I have assumed that the so-called cover or screen test, with its related subjective parallax test, is the most valuable of all tests for muscle imbalance, because it is objective and passive, making binocular fusion impossible in the most complete and simple manner, and I have further assumed that the more thoroughly the test is applied the more accurately the result will represent the truth.

The prolonged occlusion test is applied practically—in cases in which the refraction has been carefully estimated, and demonstrable errors of the muscle balance determined and recorded—by having one lens replaced by a ground glass, the other eye being furnished with

(2)

T.C.S., aet. 29.
7293.



Refraction under Scopolamine:
R. +0·25 s. +0·62 D. c. 100°
L. −0·50 s. +1·37 c. 80.°

its full refractive correction. The patient is directed to put the glasses on in the morning before opening the eyes, not to look over or under them, not to remove them for any purpose without closing at least one eye, and to wear them until the eyes are closed at night, keeping this up for seven days. At the end of this time the muscle test is made. A full refractive correction is placed in a trial frame with a Maddox rod in front of one eye: the patient is directed to close his eyes, his glasses are then removed and the trial frame, etc., substituted for them. He then opens his eyes and the tests are made. (My usual

practice is to use the Maddox rod for the vertical and the vertical diplopia test for the lateral deviations, using the screen and parallax tests as confirmatory.)

It must be admitted at once that this test is not suitable for universal use. Only patients of intelligence to whom the nature and object of the test are thoroughly explained, and who also realize, usually by much suffering and many failures in the past, that there has been some hitherto undiscovered factor in their cases, and who are also willing to submit to some inconvenience in order to obtain relief, are really fit subjects for it. But it has been my experience

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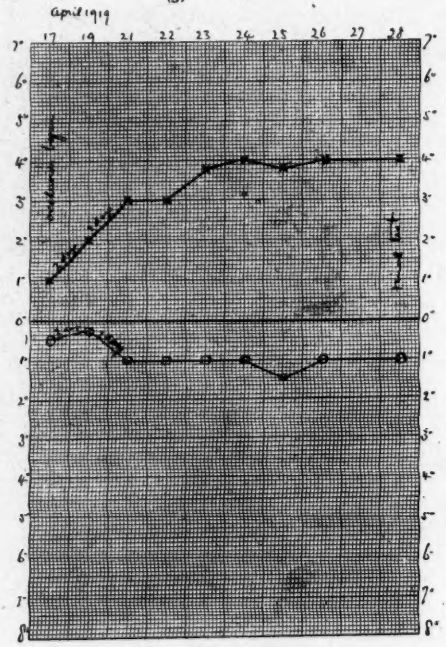


that there are a great many patients of this class, and I have rarely been disappointed in the thoroughness with which the test has been carried out by the patient.

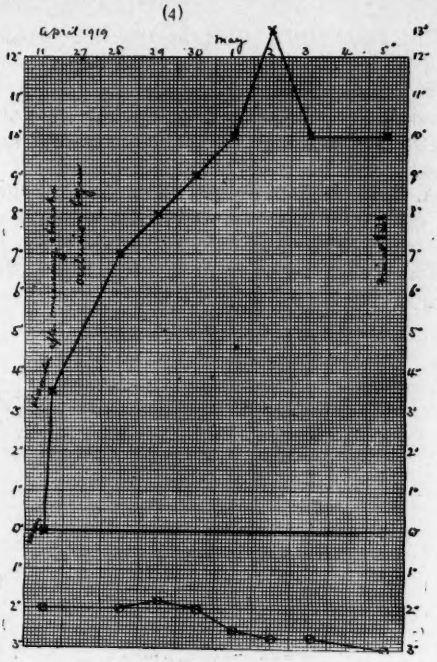
The accompanying charts illustrate more strikingly than a written description the actual results of the tests, and are self-explanatory.

No. 1 shows that a week's occlusion may bring out practically no change.

Nos. 2, 3, and 4 show daily observations and an approximation to stability at the end of a week.

(4)

Miss M. M.



Above O° line.

X = Exophoria.
O = R. Hyperphoria.

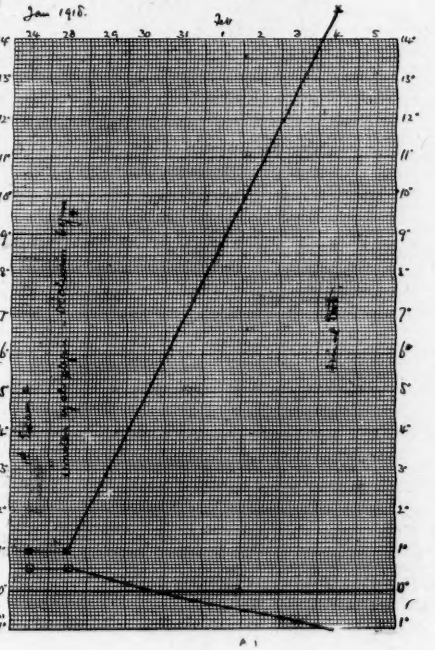
Orthophoria.

Below O° line.

X = Esophoria.
O = L. Hyperphoria.

(5)

Mrs. L.J.D., aet. 29. 6223.



Above O° line.
X = Exophoria.
O = R. Hyperphoria.

Orthophoria.

Below O° X = Esophoria.
O = L. Hyperphoria.

In the remaining cases the observations were made only at the beginning and the end of the test, showing varying degrees of increase in the amount of error, and in some, reversal of the direction of deviation.

Case 7 is of particular interest on account of the high degrees of the errors, especially of the hyperphoria, which were entirely latent before the test. This patient was referred on account of severe neurasthenic symptoms, all causes other than ocular having been apparently excluded by her medical adviser. In view of the

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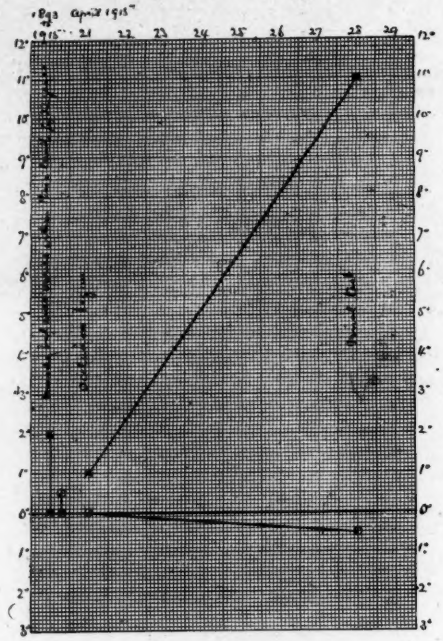

extremely low degree of refractive error and the perfect orthophoria, I was on the point of giving the opinion that ocular causes could also be counted out, but as some of the symptoms seemed to be closely related to the use of the eyes, I first advised the occlusion test. The chart shows the result: exophoria eight degrees and hyperphoria seven degrees, and the subsequent history of the patient confirmed the importance of the findings.

Cases 8 and 9 are of interest because they are those of mother and son, both having been under my own observation and that of other

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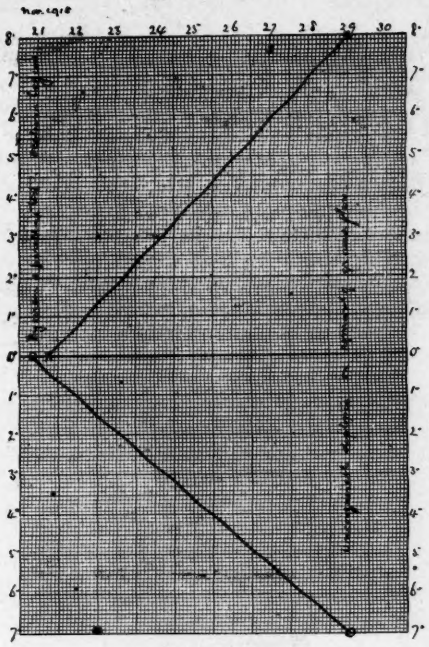
Mrs. E.P.S., aet. 28.
6927.



Above O° line:

X = Exophoria.
O = R. hyperphoria.

Orthophoria.

Below O° line:

X = Esophoria.
O = L. hyperphoria.

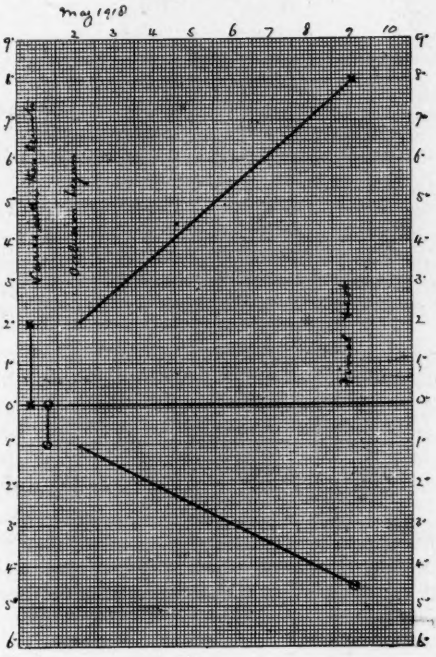
Refraction under scopolamine:

R. +0.75 s.

L. +0.50 s.

(8)

Mrs. L.K., aet. 46.
77.51.



Above O° line:

X = Exophoria.
O = R. hyperphoria.

Orthophoria.

Below O° line:

X = Esophoria.
O = L. hyperphoria.

Refraction:

R. +0.62 c. 160°.

L. +0.62 c. 25°.

ophthalmologists for ten or twelve years without satisfactory improvement being obtained.

Case 10 shows reversal of both vertical and lateral deviations.

Case 11 shows exophoria after the occlusion period, greatly exceeding the abduction as measured previously.

Experience with this test in a considerable number of cases suggests the following conclusions:

First: That the length of time ordinarily devoted to tests for the muscle balance is insufficient for the purpose. It is difficult to

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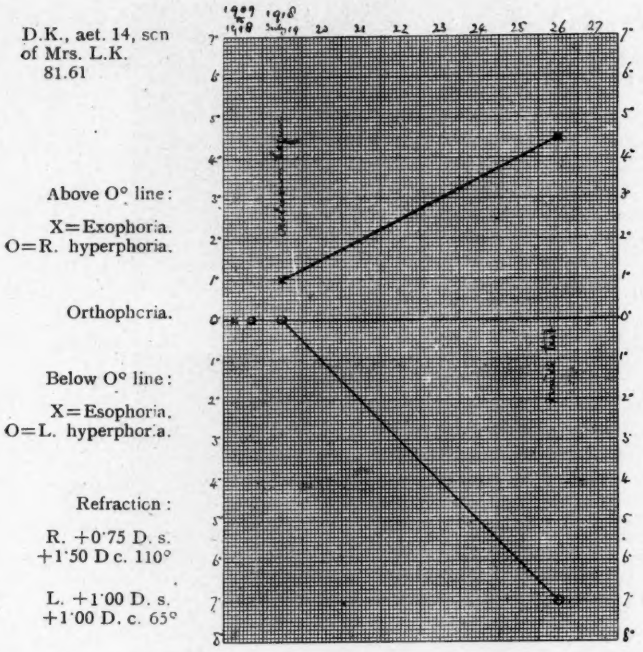

say how long a period of occlusion is necessary to bring out the total error, for there is obviously a limit to the length of time for which a patient can be subjected to the test. Some of the charts shown seem to indicate that a week is sufficient to arrive at stability, but in other cases successive tests have brought out more error. Thus, in one (Mrs. J. L. H.), the first period of seven days brought out an exophoria of four degrees, the second of fourteen days six degrees, the third of seven days, after an interval in which prisms had been omitted, six degrees, and a fourth of seven days

ten degrees. In some cases in which marked relief has been experienced by the patient during occlusion, no error has been found at the end of the period, suggesting as one possible explanation that the period has been too short to bring about relaxation of the muscles.

Second : That the results obtained by the usual brief manner of applying the test may be misleading not only as to the degree but also as to the kind of error present. One of the most striking phenomena seen is the reversal of the direction of deviation. Thus

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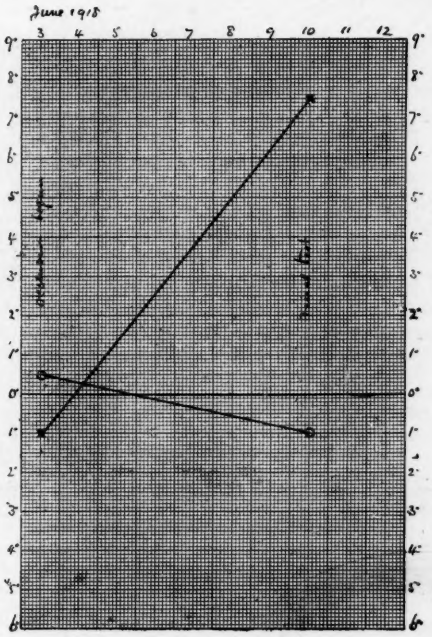
Mrs. H. W. S., aet. 43.
6573.



Above O° line :
X = Exophoria.
O = R. Hyperphoria.

Orthophoria.

Below O° line :
X = Esophoria.
O = L. Hyperphoria.

Wearing :
R. + 1·25 s. ; + 1·00 c. 60°.
L. + 1·25 s. ; + 1·25 c. 95°.
Refraction without cyclo-plegia :
R. + 1·50 s. ; + 1·00 c. 60°.
L + 1·50 s. ; + 0·62 c. 70°.

a right hyperphoria before the test may become a left hyperphoria afterwards or vice versa, the change commonly being accompanied by the development of exophoria ; or, less commonly, an esophoria changes to an exophoria, or both these changes may be seen in the same case. The most frequent change seen, however, is an increase, often very great, in the amount of deviation,

Third : That the prism duction gives no reliable indication of the presence or amount of a deviation. Previous to my experience with this test I had been under the impression that the prism abduction was to some extent a guide to the amount of possible

exophoria, and that the degree of the latter could not exceed the former. Numerous observations by the occlusion test completely disprove any constant relation between the two. The exophoria, after prolonged occlusion, often exceeds, sometimes very greatly, the abduction as measured before the test. The same may be said of hyperphoria in relation to sursumduction, though observations on this point are not as numerous as those on exophoria.

Fourth: That the effect of an operation on the muscle balance cannot be determined with any certainty without an occlusion test.

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F. K., aet. 13—20.
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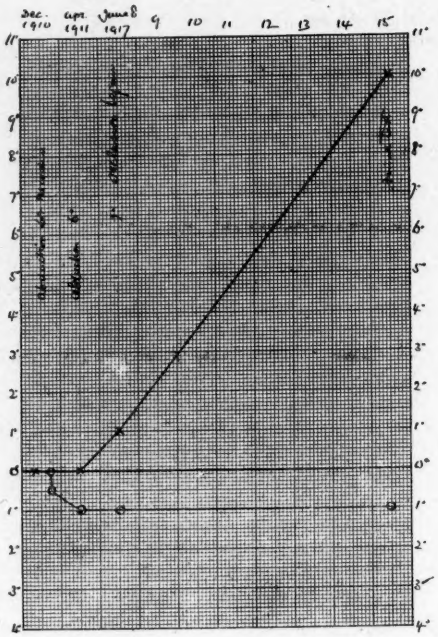

Above O° line: X = Exophoria.
O = R. Hyperphoria.

Orthophoria.
Below O° line:
X = Esophoria; O = L. Hyperphoria.

Refraction:
R. − 0·25 s.; − 0·87 c. 20°.
L. − 0·75 s.; + 0·87 c. 70°.

The cause of failure of operative measures to relieve symptoms may be shown by an occlusion test, bringing out the fact that the operative effect has been too small or too great.

Fifth: That the effect of prism exercises is to obscure or render latent an error previously manifest, such latent error being easily made manifest again by an occlusion test.

Sixth: That the test brings out conditions which make it unnecessary to assume that the constant use of prisms tends to increase an error, far greater and more rapid change being produced by the passive relaxation of the occlusion test.

Seventh: That the paralytic or non-paralytic character of a hyperphoria can be determined with much greater ease and certainty after than before the test.

Eighth: That the theory held by some that the lateral deviations are secondary to the vertical receives no support from this test so far as exophoria is concerned. If the latter were due to efforts to overcome hyperphoria, it would diminish when these efforts cease, as during an occlusion test. But this is contrary to the facts. It usually increases. In some cases of esophoria, however, the convergence diminishes, disappears, or is converted into divergence co-incidentally with increase in the degree or change in the form of hyperphoria.

A DISCUSSION UPON THE ILLUMINATION OF MINES, WITH PARTICULAR REFERENCE TO MINERS' NYSTAGMUS*

The Chairman (Mr. J. Herbert Parsons): I do not think I need introduce to you, who are interested in this subject, Dr. Lister Llewellyn. It was an extremely fortunate event when he was chosen first Tyndall Scholar, and he has very fully justified his election. He has produced an enormous amount of evidence in support of the view that the essential cause of miners' nystagmus is deficient illumination, and, at least in the opinion of most of us, he has thoroughly established that view.

Without further preamble, therefore, I will call upon Dr. Lister Llewellyn to read his paper.

a—LIGHTING CONDITIONS IN MINES WITH SPECIAL REFERENCE TO THE EYESIGHT OF MINERS

BY

T. LISTER LLEWELLYN, M.D., B.S.

ASSISTANT PHYSICIAN, NORTH STAFFORDSHIRE INFIRMARY

Synopsis of Contents

I. Lighting conditions in mines—
   General remarks.
   Photometric measurements.
II. Physiological considerations of the effects of dull illumination on the eye.
III. The effect of dull illumination on the eyesight of miners—
   Injury.
   Disease.

*This discussion took place at a meeting of the Illuminating Engineering Society, on February 24, 1920, and is now published by kind permission of that Society.

IV. Economic factors—
(1) Benefits to be expected—
Diminished incidence of accident and disease.
Increased output.
(2) Cost of increased illumination.
(3) Results obtained by increased illumination,
V. Standard of illumination required—
Comparison between candle and safety lamp.
The miners' lamp.
Conclusion.

I. Lighting Conditions in Mines

The problem of illumination in the coal mine is complicated by the presence of fire damp, by the rough usage which the lamp selected receives at the hands of the collier, and by damage due to falls of roof and coal. The presence of fire damp will necessitate the retention, at any rate for many years, of the oil safety lamp for testing purposes. The hard usage the lamp gets makes its substantial construction necessary, and the need for protection against falls most unfortunately cuts off all rays directed upwards.

As I have stated in my lecture (1) before the North Staffordshire Branch of the Institute of Mining Engineers the illumination in a coal mine depends on four factors:

(1) The candlepower of the source of light used.

(2) The distance at which this light has to be placed from the working area.

(3) The surface brightness of the surroundings.

(4) The composition of air in the workings.

(1) *Candlepower of source of light used.*—It seems incredible, but the source of light which gives the highest candlepower at the coal face is the tallow candle! By carefully spreading out the wick two candlepower may be obtained.

If measurements are taken at the coal face the modern oil safety lamp, with the exception of such lamps as the Hailwood combustion lamp, rarely gives one-half candlepower. I do not say that they will not give more, but up to 1914 I had not obtained a higher reading. The modern electric lamp in use gives about one candlepower for eight hours. I have lately seen oil and electric lamps giving two to three candlepower, but they are not yet in use. Measurements of the latest lamps in use will be given below.

(2) In the safety lamp pit the lamp has to be placed at least two feet away from the swing of the pick. The lamp is often hung on a post and there is a tendency on the part of the miner to leave the lamp fixed. The law of inverse squares and the cosine law come very powerfully into operation.

(3) *The brightness of the surroundings.*—The collier works in surroundings which are either coal or covered with coal dust. Almost all the incident light is absorbed and there is no colour relief.

Coal and coal dust absorb from 86—97 per cent. of all incident light.

(4) *Composition of air in the workings.*—The light of an oil safety lamp diminishes rapidly when the oxygen percentage of the air falls, and the presence of moisture has the same effect. A tested oil lamp actually lost 60 per cent. of its candlepower in a poorly ventilated pit. The presence of dust, quite apart from the fouling of the lamp, also diminishes the illumination obtained.

Actual measurements at the coal face.—Up to 1914, as a result of a large number of observations in several coal mines the average illumination at the coal face in a safety lamp pit was found to be 0·018 foot-candle; in candle pits the average illumination was 0·09 foot-candle. The readings are given in detail in my book.(2)

Through the help of Mr. Turner, of the Stafford Coal and Iron Company, I am able to give you measurements with the latest lamps in use.

The measurements given were all taken under the most favourable circumstances as a length of coal face had been cleared for the purpose. There was no dust, and all the lamps were fresh and clean, and in the case of the electric lamps, freshly charged. Six lamps of each of the five varieties mentioned below were used. The lamps were hung on the same nails and the coal face was marked with chalk to insure that the readings would be taken at the same place. The lamps were tested in the order given. The lamps were placed on the assumption that four holers and two loaders were working in the drift. The readings from one of the loaders' lamps give the average general illumination at the coal face, the readings from the holers' lamps give the illumination on the area actually being holed. Owing to the favourable conditions the figures are higher than they would be in actual practice. The average candle-

	Candle-power.	General illumination at coal face in foot-candles.	Illumination on actual working area in foot-candles.
Hailwood Combustion Oil Lamp ...	0.99	0.017*	0·075
Ackroyd and Best Oil Lamp	0.58	0.021	0.06
Protector Oil Lamp	0.79	0.019	0.06
C.E.A.G. Electric Lamp	0.96	0.032	0.104
Oldham Electric Lamp	1.12	0.045	0.113

* Lamp glass smoked.

power of the lamps is also given. One C.E.A.G. lamp gave the best light—1·4 candle-power, but the general average of the Oldham lamp was higher. It is interesting to note that the illumination at the coal face given by the oil lamps does not compare favourably with the candle-power of the lamp. This is partly accounted for by the greater extent of the shadows thrown by the lamp standards.

These readings should be compared with others taken recently in another pit.

Colliers top holing in a dusty seam at end of shift:

Two C.E.A.G. electric lamps, average candlepower, 0.62.

Illumination on area worked in foot-candles, 0.03.

Colliers getting coal in same seam, end of shift:

One C.E.A.G. electric lamp, candlepower, 0.8.

One Clanny oil lamp, candlepower, 0.36.

Lamps over 8 feet away from the coal face, illumination at coal face less than 0.01 foot-candle.

Miscellaneous readings—

Well-lit pit bottom. Half-watt electric lamps:

	Foot-candle.
Inset	0.9
Snapframe	0.4
Main intake...	0.2
Collier ripping top	0.018
Collier setting timbers	0.04
Repairer lamp on neck wedging hole in roof	0.05
Timberman notching arm	0.035
Haulier spragging off in parting, lamp in hand	0.06

II.—Physiological Considerations

The effect of feeble illumination on the eye has always been of great interest to physiologists. Parsons (3) in his paper on "Scotopia or Vision in Dull Illumination" discusses this question fully. With the exception of the manufacture and packing of some specially sensitive photographic plates in darkness no industry is carried out in such feeble illumination as that of coal mining. Let us take some of the signs and symptoms of miners' nystagmus and see if they throw any light on the problem of vision in dull illumination.

Loss of sight.—One of the commonest and often the first symptoms is loss of sight, especially marked at night time or in the early morning, that is in feeble light. Men with normal refraction are often unable to read more than 6/36 in the acute stages of the attack. Of 1,121 cases of miners' nystagmus only 103 could read 6/6. I have always looked upon an increase in visual acuity as a favourable prognostic sign. Cridland (4) describes contraction of the

fields of vision for colour in the acute stages of the disease and a return to normal in convalescence.

Intolerance of bright light.—This symptom is often very marked. In miners' nystagmus, then, both extremes, bright illumination and dull illumination, cause trouble. In the normal person the eye can adapt itself within very wide limits of intensity. In miners' nystagmus the range is limited and there is a special failure of adaptation in feeble illumination. Stassen (5) lays stress on the sudden changes from light to darkness and from darkness to light. In my book (page 114) I say: "Failure of dark adaptation may quite well be the ultimate cause of miners' nystagmus."

Oscillation of the eyes.—Is this characteristic sign of the disease due to imperfect fixation or to fatigue of the oculo-motor centres? In disordered action of the heart, so commonly found in soldiers, and in respiratory trouble due to poison gas, there is a neurasthenia of the regulating mechanism in the central nervous system. In both of these conditions fatigue is readily induced, and brings about results quite out of proportion to the increased work done. Does working in a dull illumination set up a corresponding fatigue?

Is the ocular movement due to imperfect fixation?

The perifoveal region of the retina is more sensitive than the foveal for dull illumination. For accurate fixation in good light the object is brought to a focus on the fovea, a definitely circumscribed and specially sensitive area of the retina. If the perifoveal area is used one point is as good as another, and an area of equally sensitive points could be found in a circle, say ten degrees from the fovea. The object may be focussed on any one of these points or on one point after another. If so, a tendency to a circular or wheel-like motion of the eye might be set up, and it is a wheel-like movement which is the typical form of oscillation found in miners' nystagmus. Lancaster[10] says that work in deficient light demands an amount of fixation greatly in excess of that called for under ordinary circumstances. Edridge-Green[6] says that the movement of the eyes is in the interests of vision.

Tilting of head.—The backward inclination of the head, which is a most characteristic sign of the disease, is, in my opinion, the result of an attempt to get the eyes in a position of maximum stability, i.e., convergence and depression, and at the same time to direct the line of vision forward.

Colour relief.—What is the bearing of absence of contrast or colour relief? Is Elworthy[7] right when he lays the greatest stress on the lack of colour relief, or are light absorption and feebleness of illumination the chief factors?

Seasonal prevalence.—Why, as Dransart,[8] Elworthy,[7] Ohm[9], and myself[2] have pointed out, should nystagmus be more common in the winter months? Ohm accepts my explanation that in winter

the absence of sunlight (coal workers in the old days rarely saw the sun except on Sundays) interferes with the normal formation of pigment in the retinal cells. Stassen[5] says that nystagmus is commoner among men working by day. Think of the colourless plant striving to grow in the cellar and of the nystagmus of albinoes. I think also that miners' nystagmus is commoner in men with fair hair and light coloured eyes.

Glare.—Although glare is generally associated with light of great intensity, in the low illumination of a coal mine any direct rays of light which fall into the eye produce inconvenience, amounting, in the case of the nystagmic worker, to discomfort or even pain. Many colliers also work in a reclining position, with the lamp at their feet, so that the light shines obliquely into their eyes. It is known that the effect of glare is increased when the source of light has a black background, and diminished when a white reflector is used. Very few colliers will work at the coal face with a reflector, as the amount of working area illuminated is too small, necessitating frequent changes in the position of the lamp. Mr. Turner, of the Stafford Company, gave a man working on a coal cutter a bull's eye miners' rescue lamp. The man refused to use the lamp after the first day, his reason being that he had to keep changing the position of the lamp continually. Would it be possible, however, by the use of a very large reflector with a matt surface, to give a diffused light over a comparatively large area, and so avoid glare?

Quality of light.—It has been suggested by Nicholls that the eye has developed itself to be most sensitive to yellow light (Quoted by Trotter "Illumination," page 173). Given equal candlepower, up to five candlepower, are the yellow rays of the candle or oil lamp more restful to the eyes than the "hard" white electric light? What would be the effect on candlepower of a coloured screen in front of an electric lamp? Men suffering from miners' nystagmus have complained of the glare of the electric lamp, but it is a well established fact that men, after failure with oil lamps, have been able to continue when given electric lamps. I do not think myself that the question of hardness should be allowed to influence the more vital question of candlepower.

III.—The Effect of Dull Illumination on the Eyesight of Miners

(1) *Injury.*—Miners, from the nature of their work, are very subject to injuries of the eye. In the same way as the tattooing of the skin by coal dust indicates his calling, so do the corneal scars, so frequently seen in old miners, tell of old injuries received. Although the injury to the eyes can only be indirectly attributed to bad illumination, the difficulty of attending promptly to the foreign body makes the prognosis in these cases bad, and loss of the eye frequently

follows a comparatively trivial injury. In an investigation of the factors concerned in the causation of industrial accidents Dr. Vernon ([11]) found that accidents to the eye due to foreign bodies were from 7—27 per cent. more numerous in the night than in the day. In 269, or 18 per cent., of my cases there was a distinct connection between the history of an accident to the eye and the onset of nystagmus.

(2) *Disease.*—In my opinion, the dominating factor in the production of miners' nystagmus is the low illumination found both in the open light and safety lamp coal mine. The arguments in favour of this contention are given at length in my book before referred to.

Ohm says: Wherever the Wolf benzine lamp is used the disease is not prevalent.

Stassen ([5]) has recently issued some interesting statistics which support this view. His results are given in the table below.

Mode of Lighting.	Luminosity in Heffner units.		Influence on Nystagmus.		
	Beginning of shift.	End of shift.	Grave cases per 10,000.	Serious cases per 1,000.	No. of cases to % of workers on day shift.
Oil Safety Lamps	0.50	0.28	35	57	31
Benzine Lamps	1.01	0.80	12	44	21
Candles and Naked Lamps	0.7	0.7	0	13	28
Electric Lamps	1.75-2	1½-1¾	8	12	15·4
Acetylene Lamps	8-15	8-15	0	0	0

IV.—Economic Factors

We are by this time agreed, I hope, that the illumination in the safety lamp coal mine is insufficient. Three considerations stand out—

(1) What benefits may be expected with an increased illumination;

(2) Will these benefits justify the increased cost;

(3) Results obtained from increased illumination.

(1) *Benefits to be expected.*—The Departmental Committee on Lighting in Factories (1915) after a very thorough examination of evidence, supported by experimental work, came to the following conclusions:

The effects of unsatisfactory illumination are—

(A) Accidents. Increased prevalence.

(B) Damage to eyesight and health.

"There is a general impression that unsatisfactory lighting is, in various ways, prejudicial to health."

(C) Diminished output. Generally admitted.

If these results are found in the comparatively good illumination of factories, how much more should they be found in the admittedly bad illumination of the coal mine.

Incidence of accident and industrial disease.—Let us see first what accident and industrial disease cost the coal owners.

(A) *Accidents.*—The figures quoted are taken from the blue books "Statistics of Compensation," last published in 1914 for the year 1913.

In 1913, 195,387 accidents occurred in the mining industry of Great Britain. For the years 1909-1913 inclusive, the average cost of compensation per person employed was 22s. With the present 75 per cent. increase in the rate of payment this figure will be correspondingly increased. From 1909-13 the cost of compensation rose yearly, and it is probable that for 1920 the average cost per person employed will be over £2.

Official returns state that in 1919, 1,113 fatal accidents, causing 1,176 deaths, took place in the mines of Great Britain.

How many of these accidents, both trivial and fatal, might have been prevented with better illumination?

It is alleged, and quite justly alleged, that many accidents are due to carelessness on the part of the workmen, but might not increased illumination lessen the incidence of these accidents? In my official capacity I see thousands of accidents every year and I have often been struck by the history given by the men. I have often felt that so little separates the occurrence from the non-occurrence of many of the smaller accidents which mount up so in the aggregate and cause much loss of time. Quite trivial accidents lead to serious consequences. A stiff finger may throw a man out of work for months. The more serious accidents generally occur from falls of roof at the coal face or in the main roads from insufficient spragging of the loads. It is commonsense to say that, with a better light especially with a lamp that can be tilted without fear, the examination of the roof for the treacherous cracks which indicate the coming fall will be facilitated.

Out of 3,333 consecutive accidents in one mining district 3,057 occurred underground. The coal face was responsible for 52.27 per cent., the haulage roads for 45.6 per cent., and the shaft and pit bottom for the rest—2.13 per cent.

(B) *Industrial disease.*—In the paper read at Stoke I stated that over 6,000 men had been disabled every year since 1913 from miners' nystagmus and that the cost to the country, not to the industry, was one million pounds a year. The paper was reprinted in the leading colliery journals and was the subject of a leading article

in one journal. No adverse criticism was made on the figures which, may then, be taken as approximately correct.

The average age at failure in my cases was 40 years. The services of able-bodied men of 40, then, may be lost to the State when they should have twenty years of working life before them. We may say that accident and industrial disease cost the colliery proprietors two million a year and the State much more.

(c) *Output.*—If you conserve your man power by diminishing the incidence of accident and disease you will necessarily increase the output. As a direct result of increased illumination you should have an increased output.

(2) *Cost of increased illumination.*—A commercial proposition?

Quite apart from the moral obligation of the coal owner to alleviate the conditions under which his employees work I hold that the expense incurred in increasing the illumination is sound commercially. I am sure the colliery owners would be only too willing to introduce new installations if they were sure of obtaining a satisfactory lamp. In a discussion ([12]) last month on a paper on safety lamps by Mr. James Jackson before the Lancashire Branch of the National Association of Colliery Managers, Mr. A. Miller said "A point that had struck him was that they were using the same lamps as they did 30 years ago, a fact which was no credit to the mining community generally—it was sufficient if they got a light which was good and could burn for ten hours. That was what was required, and the sooner the inventive minds in the country turned their attention in that direction, and the sooner the owners let makers know they were prepared to pay for it, because it would be one of the cheapest things they could have, the better it would be for the mining community."

The electric lamp costs from ½d.—1d. a week more than the oil lamp, but the original cost is much higher.

The cost of the oil lamp is generally given at 3½d. per lamp per week. The cost of the electric lamp varies very much. Mr. Johnson estimates the cost of the electric lamp used at the Mossfield Colliery at about 2½d. per lamp per week. Figures quoted by lamp manufacturers, including cost of lamp, show the cost to vary from 0·79—0·82 of a penny per shift without current or labour. Upkeep costs may vary from 1d. per lamp per week in the first year to 3d. in the third year when renewals and purchase of duplicate parts are required.

I think the lamp of the future will be the electric lamp and already large numbers are being installed. One firm claims to have nearly 200,000 of its lamps in use, including installations of 12,000 and 15,000 lamps to two companies.

Results of increased illumination.—I have shown you the magnitude of the subject and you will ask if I have any figures to support

the contention that increased illumination diminishes the incidence of disease and accident and increases output.

(1) In the open light pit nystagmus is rare, in the safety lamp pit the disease is common. I have shown that the illumination in an open light pit is five times that of a safety lamp pit. No comparison can be made between these pits from the point of view of accident.

(2) In my own district, the Mossfield Colliery Company own two pits a couple of miles apart in which the same seam is worked under exactly similar conditions. Six years ago nystagmus was equally common in both pits and the Manager, Mr. Caleb Johnson, started to introduce electric lamps into one of the pits. I went down one of the pits (Pit A) and took photometric readings six years ago and I have repeated these tests in the second pit (Pit B) last week. The readings, together with Mr. Johnson's figures as to output, incidence of disease and accident are given in the table below:—

	Lamps used C.P.	Illumination at coal face in foot-candles.	Cost of Nystagmus per ton.	Shifts lost from accident.	Output per person per shift.
Pit A ...	Oil 0.25	0.015	¾d.	1 in 23	100
Pit B ...	Electric 0.62	0.023	negligible.	1 in 54	105

These measurements were all taken at the end of the shift in a very dusty seam.

I include some figures from South Wales, where the introduction of electric lamps has been carried out on a large scale.

Dr. Phillips has kindly sent me the number of fresh cases of nystagmus occurring during the last five years among 10,000 colliers working for two companies. In one company oil lamps alone are used, and the yearly incidence percentage of nystagmus is 0.57; in the other company, nearly 50 per cent. of the lamps used are electric, and the incidence of the disease is 0.175.

Dr. Phillips writes: "The incidence of nystagmus is undoubtedly greater where oil lamps only are used. I am also convinced that the presence of nystagmus is responsible for a large number of accidents."

Dr. Elworthy says that for the years 1909-1911 the percentage of nystagmus among underground workers was 0.71. With improved ventilation and the introduction of over 6,000 electric lamps the incidence fell in 1919 to 0.1 per cent.

In the *Ophthalmoscope*, Vol. XIII, Mr. Coulter, of Newport, quotes a letter from the Manager of a group of Welsh Collieries employing 2,600 men. The letter is slightly abbreviated:

"Sir,—We had had 102 cases of nystagmus certified, but a far greater number of men have appealed to us for electric lamps. Electric lamps on a small scale were introduced June, 1912. A

number of cases working on surface have returned to work underground with electric lamps. From experience gained we have come to conclusion: 1st, that insufficient light causes nystagmus; 2nd, that the introduction of electric lamps has enabled scores of our workmen to continue working underground; 3rd, that the use of an electric lamp is a good preventative of nystagmus."

V.—Standard of Illumination Required

Nystagmus is common in oil safety lamp pits, and rare in candle pits. If, then, we compare the light given by the oil safety lamp in general use with that of the candle, we may be able to set up a standard of minimum illumination. In the following table the value of the candle has been taken as 1 wherever possible.

	Candle.	Safety Lamp.
Distance from coal face	1	2-6 times as far.
Candle-power	1	0.5
Spherical candle-power	1	0·22
Area illuminated	1	0·5
Illumination at coal face	1	0·2
Mobility	Can be placed anywhere.	Fixed.
Constancy	Remains constant.	May lose 30%
Relighting	Easy.	Difficult
Attention required	Nil.	Frequent

I suggest the standard to be aimed at be that of the candle pit—an average illumination of one-tenth of a foot-candle—over the whole working area. A cap lamp of one candle would give a greater illumination than this, but the ordinary lamp placed at least twice as far from the face as a candle, must be of three to four candle-power to give the same result.

Last week I was able to test underground this Oldham electric lamp, which I now show you. While walking to the coal faces I wore the lamp in my belt and the whole of the travelling road was well lit up. I have never picked my way so easily in a pit. At the coal face the lamp was worn in the cap and the following measurements were taken:

Candle-power	0.95
Drilling shot hole	0.1 foot-candle*
Working ratchet machine ...	0.55
Examination of roof	0.25—28
Holing	
Kneeling	0.18
In semi-reclining position ...	0.18
Full reclining position, coal undercut, 2 feet 3 inches	0.08

*A Hailwood combustion lamp placed in nearest position gave 0.02 foot-candle.

Compare the last readings given with the average general illumination of an oil safety lamp coal face, 0.018 foot-candle, and with the results given in Table 1.

The most striking features about the lamp are the large area and uniformity of illumination and the absence of shadows. The old Japanese proverb that the darkest place is just below the candlestick fortunately remains true and the workers' eyes are consequently protected from all glare.

If the lamp is held two feet three inches from a blank wall an area 15 feet wide and ten feet high is illuminated. The weight of the lamp is 2¾ lb., the lamp itself and twelve inches of cable weigh seven ounces, a small weight for men who have been used to wearing a steel hat.

Examination of the roof can be carried out very quickly and efficiently. I was very impressed with the trial and predict a great future for a lamp of this character. The advantage of taking your light with you wherever you go and always having it most advantageously placed makes the cap lamp about 6·8 times as efficient as an ordinary oil safety lamp and two to three times as efficient as the electric lamps in present day use. I suggest the lamp be given a trial in the first place in the haulage roads where the lamp has to be continually carried about, and where twenty per cent. of all oil lamps are extinguished each shift.

The miner's lamp.—The miner's lamp should be safe, foolproof, and of simple construction. It should be of substantial make and easily taken to pieces for repair. If not built to stand the rough usage it will undoubtedly receive, no repeat orders will be obtained, and discredit will be thrown on the industry. A constant steady light for at least eight hours is required. The area illuminated should be as large as possible and few shadows should be thrown. The lamp should be easily re-lighted and require no attention. An easily adjustable and readily removable reflector should be fitted.

The purely technical questions of the relative advantages and disadvantages of the acid and alkaline cells, the high upkeep cost and variability of bulbs and other kindred matters I leave to the makers, but I must call attention to the poor quality of the glass supplied, both to the oil and electric lamp manufacturers. A good light may be quite marred by the poor quality of the lamp glass.

Lamp-room organization.—Under this heading I only wish to call attention to the importance of the lamp-room, which should be the show place of the colliery and under the care of a thoroughly capable and experienced man. The proper cleaning of lamps, especially oil lamps, is of great importance and machine brushes should be fitted. Lamps cannot be cleaned by hand without undue multiplication of the staff.

Miners' Lamp Committee.—At the present moment there is, sitting in London, a Committee to inquire into the improvement of the miners' lamp. Let us assume for the moment that they will decide that, although the lamps of the present day show great improvement, the standard reached is not sufficient for them to recommend the general introduction of any one lamp. What will they do? Will they leave the future of the lamp in the hands of manufacturers, laying down a standard to be aimed at, or will they throw the onus on the coal industry? This brings up the question of research and the advisability or otherwise of apportioning a sum of money for this end.

I hope it will be the privilege of this meeting, which Mr. Gaster has striven to make as representative as possible, after pointing out the urgent need for increased illumination in our coal mines, to indicate the methods for obtaining this end. I myself am full of hope, as the coalowners, who, as a class, have always the best interest of their employees at heart, now realise the importance of the question. I think that in this twentieth year of the twentieth century the long continued supremacy of the farthing dip will be finally ended.

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b—ILLUMINATION IN COAL MINES—SOME OBSERVATIONS

By H. S. ELWORTHY, F.R.C.S.

EBBW VALE, MON.

To illuminate coal mines satisfactorily, what is required is a safety lamp that will give sufficient light, and of a suitable quality to enable the miner to work without getting the disease known as miners' nystagmus.

This is a disease of the nervous system, and not one of the eye only.

As mines become older, and the coal further away from the fresh air shaft, the air becomes more deoxydised, and oil lamps give less

light. It must not be forgotten that if the air is so bad that a lamp will not burn properly, it is bad for the man to work in it, and simply to provide a better light and leave him to work in bad air is not a complete remedy—it is only a partial one. The conditions in coal mines are different from those in any other occupation.

Tho colour of coal is nearly black, containing from $2\frac{1}{2}$ to $3\frac{1}{2}$ per cent. of white, and the slack is sometimes as black, but more often slightly lighter.

The colour relief is the average of these taken together. Here is a card showing the colour of one of our pits; it contains between $2\frac{1}{2}$ and 3 per cent. of white.

I will give three examples of conditions found in steam coal pits:

	Candle-power of lamp.	Colour relief.	Surface brightness.	Distance lamps apart.
Pit 1	0.1	2.7	0.00058	15 ft. 6 in.
Pit 2	0.19	2.55	0.00055	18 ft.
Pit 3	0·12	3.3	0.0004	8 ft. 6 in.

Here men work in surroundings with only 3 per cent. of colour, or less, with lamps from 8 to 15 feet apart, giving from 0·1 to 0·2 candle-power, and where the coal only reflects from half a thousandth to a four-thousandth part of a foot-candle, and that light appears as small glistening white or bluish-white specks. No red or yellow is seen. The roof in some places is black and glassy, and is faintly radioactive. Here is a photograph taken by placing lead letters on a plate, and the piece of roof resting on them.

If a man works 20 years with his head close under such a roof, it is just possible that it may have some effect on his nervous system, but I rather doubt it.

Concerning nystagmus, a paper of mine was published in the *British Medical Journal* for November 19, 1910, in which I suggested that more colour should be introduced into mines, and that the men should have more daylight; and in another paper, which appeared in the *Ophthalmoscope* for December, 1912, it was shown in the reprint that the incidence of nystagmus was inversely proportional to the chromophotic index of the mine, and that I had found no nystagmus when this index was as high as 500.

The chromophotic index is made up of three factors—the candle-power of the lamp, the surface brightness of the coal, and the colour relief. We cannot alter the surface brightness to any extent, but we can alter the colour relief by passing the posts through a light

wash, or by colouring the roof, and we can alter the candle-power either by improving the ventilation or by introducing electric lamps.

So far colliery owners do not seem to fancy introducing colour, and problems of ventilation are very difficult, so they prefer to increase the candle-power of the lamps.

In the Ebbw Vale collieries for the years 1909, 1910, and 1911 our percentage of nystagmus among underground workers was 0·71, the general percentage for South Wales was 0·17, and for the Anthracite Field, 0·019, so we had four times as much as the average for South Wales. Since then certain changes have been made.

A new fan was put into one mine, haulage engines are now worked by compressed air, so more gets into the mines.

Electric lamps were introduced in 1914, first the C.E.A.G., and these have now been replaced by the Oldham lamp. We have over 6,000 of them now.

In 1914 we had 0·73 of nystagmus, and the next year it had dropped to 0·22. Then the war came and "summer time" was introduced, and then shorter hours, so the men got more daylight.

A number of our colliers went to the war, and their places were taken by new men who would not be likely to get nystagmus for years.

For last year, 1919, our percentage had dropped to 0·1, the general rate for South Wales was 0·28, and for the Anthracite Field 0·16, so we had less than half the average.

In looking over my papers for 1913 I find two calculations to determine the minimum candle-power required to bring two of our worst pits up to the safety margin, that is to say, a chromophotic index of 500, and in both cases the candle-power required was 0·9.

This coincides very closely with Dr. Llewellyn's results, as he suggests that it should be one candle-power.

But let me make it quite clear that when I say a miner's lamp should be one candle-power, I mean that the light that passes through the thick outer glass is fully equal to a standard candle. I certainly do not mean that the little electric bulb may give one candle-power, but when the outer glass is put on, the light is a good deal less. To call such a lamp one candle-power is misleading.

Now, as to the quality of the light. With an oil lamp, one sees a rich yellow light with a tinge of red in it when in fresh air, but on arriving at the coal face, where the candle-power has become reduced, say from 0·5 to 0·1, a very noticeable change is to be seen. Although the flame is practically the same size, it has become distinctly paler. Part of the red and yellow rays have disappeared, and the flame looks pale bluish-white. On returning to the surface the yellow and red appear again. In places where the coal reflected a large proportion of blue, with this pale bluish light, I noticed a sensation of strain and discomfort in the eyes, but in places where

the coal did not reflect much blue it was not noticed. In one of these bluish pits where the roof had been whitewashed for experiment, I and others noticed a distinct sense of relief to the eyes when passing under it.

The light that affects the eye of a miner is that which is reflected into it from the coal. That is the important point.

Experiments

In order to find out what rays were most irritating to the eyes, I got some light filters which roughly divide the spectrum into three equal parts, red, green, and blue.

With a small lamp in a dark box, a ray of light was passed through these filters, through an aperture 1 mm. in diameter, thus showing a small spot of light in a dark room.

Thirty people were tested by these lights.

After looking at the spot of light for a short time, the visual purple in the retina where the light falls on it becomes exhausted, and the eyes unconsciously move in order to focus it on other parts of the retina and so enable it to be seen, and this is what happens in nystagmus.

These experiments led me to conclude that the red and green caused the most active movements, but in the case of the blue the spot of light quickly disappeared, to reappear and disappear again. It seemed to exhaust the visual purple more than the other colours, but caused less active movements.

If, however, all red rays were excluded by using a blue-green glass, or a methyl-violet filter, the movements were active, but the tendency to disappear remained.

In the case of a man who was rather subject to watery eyes, the effect was remarkable. The red and green gave the ordinary movements, but no trouble; but the blue brought on profuse lacrymation, and after about five minutes his lids were swollen up, and he looked as if he were suffering from a severe cold.

Another man experienced smarting in the eyes when methyl-violet was used.

It seems to me evident that the rays from the violet end of the spectrum—which may include ultra-violet rays—have an exhausting and irritating effect on the eye, and an excess of them is to be carefully avoided in any lamp used in a mine.

In cases of incurable nystagmus I have known men to suffer severe pain in the eyes and head for years after they had left work, and the pain often came on at night, when they were not using the eyes, so they got up and tramped about the house because they could not sleep for pain. This did not seem to be due to errors of refraction, because supplying new spectacles did not cure it.

The condition must surely be brought about by something other than the mere working in a defective light. It seems suggestive of something in the nature of an X-ray or ultra-violet burn, and I have a strong suspicion that there is a distinct relationship between incurable nystagmus and the rays from the violet end of the spectrum.

In my series of 200 cases, there were 10 incurable, and eight out of these worked in pits where the light was pale and the coal reflected a large proportion of blue.

By using these light filters, and a corresponding filter over the eyepiece of a photometer, it is possible for a sensitive eye to make a rough analysis of various lights, and of the light reflected from different sorts of coal.

To give a few examples:

	Blue %	Green %	Red %
Tallow candle	5.53	28.84	67.63
Marsaut oil lamp	7.2	22.2	70.6
Carbon filament electric ...	6.64	26.63	66.63
C.E.A.G. electric	13.63	31.13	55.24
Oldham electric	—	—	—

Here you see the metallic filament lamp gives out twice as much blue as the carbon, or tallow candle.

Light reflected from coals:

	Blue %	Green %	Red %
House coal, Forest of Dean ...	4.5	13.3	82.1
Anthracite	4.7	23.9	71.4
Welsh steam coal	9.0	26.0	65.0
Ditto	9.12	33.43	57.45

Here you see the steam coal reflects twice as much blue as the anthracite or the house coal, and it is in the steam coal pits that we get the most nystagmus.

From these remarks it might appear that the problem of miners' nystagmus is comparatively simple, but to me it is exceedingly complicated and puzzling. My observations have been few, and confined to one locality, and it would be unwise to generalize from them unless confirmed by others.

Only once have I noticed an oil lamp look yellow at the coal face, and then the conditions were probably abnormal. The intake

airway was partially flooded that day, so we had to go in by the air exit. While going in there was a fall of roof partially blocking the way, but a few hours before there had been a fall just before the last working place was reached, completely blocking it up. By the time we got there a small passage had been made large enough for us to crawl through with my apparatus.

Here the flame of the lamp was distinctly yellow, and from its appearance I judged it to be 0·4 or 0·5 c.p., but on measuring it found it was only 0·12. Yet the flame was not small.

On analysis it was found to contain blue 5·2, green 21·4, red 73·4, which is very much what it would have been on the surface. As you know, if a small oil lamp is turned down till it gives only say 0·2 cp., it looks bluish. Such a flame gave on analysis: blue 9·5, green 26·9, red 63·6, so that an explanation of the yellow flame seen in the mine can only be arrived at by knowing the composition of the air. In other parts of that pit the flame was pale. The presence of certain gases may have something to do with nystagmus. Much research is required before we can profess to know all about it, and very great care should be taken in illuminating, lest a light be introduced which for a time seems beneficial, but which in the course of years may easily result in a greatly increased output of nystagmus of an incurable type.

We have found that the cost of running the C.E.A.G. lamp runs out at about—taking the whole of the costs from the beginning, for the last six years—1.29d. per shift, which we regard as a very reasonable figure, seeing that it was much lower in the first years, as the cost of labour and materials has latterly gone up considerably.

If you gentlemen were called in to improve the lighting of a room with a very dark and dingy paper, I think the first thing you would do would be to order a lighter one, that would reflect the light better. It is the same principle in coal mines. If, instead of working with a tenth of a candle power in coal, the men were working in chalk, there would be no nystagmus. They would have a better illumination, because chalk reflects, say, from 90 to 95 per cent. of light, but coal less than 9 per cent., so that in chalk the tenth of a candle would be equivalent to more than a full candle in a coal mine.

It is not so much the amount of light thrown on the surface that matters, but rather the amount reflected back, and that is why I hold that the cause of nystagmus is the absence of colour in coal, because, for that reason it does not reflect back the light. (It only reflect as much as it does on account of its crystalline structure. If it were not crystalline it would only reflect from 2 to 3 per cent. of light.)

The three things I want to see introduced into coal mines are: (1) colour, (2), more fresh air, and (3) a proper amount of light of

a suitable quality, for I quite agree that a fifth or a tenth of candle power is a ridiculously small amount of light to work with. If you are about to establish a standard of quantity, I wish you also to establish a standard of quality. My ideal is the carbon filament or the tallow candle—a proper amount of yellow, and not too much violet.

I wish here to acknowledge that I got the idea of the spot of light moving in a dark room from Dr. Edridge-Green, and the method of making an analysis of light from one of your secretaries, Mr. J. S. Dow.

c. Discussion

The Chairman: Mr. Elworthy has given us some very interesting aspects of the subject. And now it would be interesting, I think, to hear a physiologist, and therefore I will ask Dr. Haldane to speak. Dr. Haldane is well known for all his work in mines, and I am sure we shall be glad to hear what he has to say on this subject.

Professor J. S. Haldane, F.R.S., Oxford: I am afraid, Mr. Chairman, I have not much I can usefully say on this matter. I came here to learn. From one or two remarks Mr. Elworthy made, I take it he thinks the air in the mines has some influence in the causation of the defects we are here to discuss. I think, however, it is probable that it has nothing to do with the question of nystagmus. The air in mines is extraordinarily pure, as a whole; a miner works in an extremely good climate, as a general rule. If you analyse the air at the working face in an ordinary well-ventilated mine—as nearly all big mines now are—you will find the air extremely pure. There is often, it is true, some fire-damp in the air, methane instead of nitrogen, but it seemed to be the same as ordinary air, in my experience, except that one's voice was altered a little. I was quite happy in it, and I kept animals in it for quite a long time. It is an indifferent gas, like nitrogen. I do not think we can blame the air in mines with regard to this condition, and I think it will be well not to complicate the problem by introducing it.

I came really in the hope of hearing something from the Chairman, and others too, perhaps, on the general nature of nystagmus. It interests me very much from the point of view of other forms of what one calls localized neurasthenia, such as we have seen so much in connection with the war. I have particularly had to do with what I may refer to as neurasthenia of the nerve centres which govern breathing, the respiratory centre. That is a very common condition, in which the breathing, instead of being of the ordinary deep and fairly slow type on taking exertion, becomes very rapid, shallow, and inefficient. There is a very well known group of symptoms which are associated with this form of neurasthenia of the respiratory centre. The same condition can be produced ex-

perimentally by simple fatigue, that is to say, by breathing against resistance, as one sometimes notes in some forms of mine rescue apparatus. The breathing is more rapid and more shallow, and you get a chronic condition, very much like that of neurasthenia as so often seen in civil life, as well as in soldiers during war time, sometimes as the result of over-strain, very often following gassing, and also seen in connection with some forms of infectious disease. The point is, that in these cases the respiratory centre is working too quickly; instead of the breathing being deep and slow and effective, it is rapid, shallow, and ineffective. You find the same sort of thing in connection with the nerve centres governing the rate of the pulse, and so on, a form of localized neurasthenia affecting those centres. There are very often other manifestations of the same sort. For instance, photophobia after gassing is very common, though there is no need to speak about that here. The Chairman, particularly, could say much more about that than I can. I am very much impressed with what are called the localized neurasthenias, and their relationship with some form of fatigue. There is fatigue of some kind connected with the miner trying to see in semi-darkness, and that, apparently, leads to this chronic nervous condition. I should like to see this produced in animals experimentally. I do not mean that anyone should deliberately make himself into a case of nystagmus, but that he might be able to produce it just for a time, as one can fatigue the respiratory centre, or even by fatiguing the heart, you can reproduce the condition, to some extent. I hope to hear something on this aspect of the physiology of the subject from the Chairman, and from any others here who have studied the subject.

The Chairman: It is a very wide and interesting subject, and we medical men must not monopolize the whole of the discussion. I will now ask Mr. Armitage, who is Chairman of an important colliery, to give us his opinion on the subject.

Mr. Armitage, M.P.: I am not able to speak on this subject in the same way as Dr. Haldane has, but I thought it might interest members to hear some details about what is going on in some of the big collieries in Yorkshire in connection with this subject.

You may remember that the Government offered a prize of £1,000 in 1911, which was given anonymously then, but, I think, it is now common knowledge that it was given by the late Sir Arthur Markham. It was for the best electric lamps, the specification for which was drawn up, from the colliery point of view, by Charles Rhodes, and from the electrical point of view, by Dr. Merz, and they were the people who decided to whom the prizes should be given. A very large number of lamps came in from all portions of the world, even from as far away as Japan, and the result was the C.E.A.G. lamp got £600, and a number of other designs received £50 apiece. We, therefore, placed orders for 10,000 C.E.A.G. lamps. We

have had those working since 1912, the year they were introduced. We are now beginning to get the facts and the knowledge which, I think, will be good enough, in a very short time, to warrant the Government taking a very much more active part in this work.

Some of you may like to know the results we were getting from these lamps. We noticed that there are three things happening about these lamps. First of all, since their use, there has been a reduction in the amount of nystagmus, and there is a reduction in the accidents. The lamp enables the men to get away from the pit bottom much sooner than they could with the old lamp: they can get their eyesight quicker. At Hickleton Main Colliery, one of the largest, they had, in 1912, 2,667 men employed, and there were 459 accidents, and 12 cases of nystagmus. That was the year before the C.E.A.G. lamps were introduced. In 1919, there were 2,058 men employed, and the number of accidents 256, while the cases of nystagmus numbered seven. I admit that the cases of nystagmus had varied considerably, because in 1918 there was no case of it at all. In another colliery, Broadsworth Main, one of the mines in the near neighbourhood, the number of men employed before the C.E.A.G. lamps was 2,464, the accidents were 439, and the cases of nystagmus 11. In 1919, 2,911 men employed, and 419 accidents, with five cases of nystagmus. In a neighbouring colliery, employing about the same number of men, but where they never used oil lamps —it was sunk about the same time that the C.E.A.G. lamps came in —they had about six cases of nystagmus a year.

Dr. F. Shufflebotham (Newcastle-under-Lyne): I have taken an interest in the subject of miners' nystagmus for many years, and it seems to me that it is only within the last year or so, or perhaps the last month or two, that there has been any active interest and real effort to come to grips with this disease, and try to check its incidence. And I think it is most hopeful when a society like the Illuminating Engineering Society joins with the Royal Society of Medicine in endeavouring to combat this disease. I feel that Dr. Llewellyn has under-estimated, and considerably under-estimated, the number of cases of miners' nystagmus which exist in this country. There is a great difference between the number of certified cases, and the actual number of these cases in existence. I am sure it is only through such agencies as these societies that we can really tackle the disease as a whole. I am confident that the Illuminating Engineering Society is anxious to do all it can to produce the best possible illumination of the mine, and medical men connected with the mining industry, and physiologists like Dr. Haldane, and others, are anxious to check the disease.

There is one other point I would refer to, and it is this: both Dr. Llewellyn and Mr. Elworthy have referred to it. It cannot be too clearly understood that miners' nystagmus is a general nervous

disease: that it is not simply a disease of the eye, and I only hope that this will be realized by every section of the medical profession and by hospital authorities too: because at the present time—I do not want to cast reflections on the specialists of this country—, specialists have, to a large extent monopolized the treatment of these cases, and while those specialists have been in a position to deal with the eye symptoms, and the treatment of those, the general nerve symptoms, which are so distressing and cause so much incapacity for work, have been practically neglected. I only hope that in the future there will be some improvement in this direction also.

Mr. Fudge said: I am Secretary of a Government Committee, which has been at work for the best part of twelve months, and their chief object is to improve the miner's lamp. And I think I may say—though I am not in a position to give details—that we are getting on satisfactorily. I must confess, however, that when we came to tackle the question, we found there was no broad road along which an easy advance was possible. I see a number of lamp makers' representatives, and therefore I feel somewhat diffident about saying what I propose to say, namely, that they have served the colliers of this country very well. I have visited a number of the proprietors at their works, and they have taken a great interest in the subject. And they have done much research—not only technical research, but pure scientific research, too—to improve the safety lamp, and they have improved it. But there are very definite limits to it, taking the lamp as it is at present constructed. Taking the electric lamp first, there is a definite limit in regard to that. That limit is in the matter of its weight, because of including a secondary battery. The candle-power could be increased, and, I suppose, indefinitely increased, by adding to the weight of the lamp. But the lamp is now about as heavy as a miner's lamp can well be. The only way to increase the candle-power of the electric lamp, on the present lines of construction, is, first by increasing the efficiency of the battery. I think a good deal may be possible in that direction. Secondly, there might be improvement by eliminating a very large amount of the shadow cast by lamps now. I do not know what the total illuminating power of the bulbs of these electric lamps is, but much of it is cut off by the electric lamp bulb, and by the pillars and the top and bottom of the lamp. It seems to me much of that shadow can be obviated by care in the matter of design. Then there is the question of the efficiency of the bulbs, and an improved quality of glass used. Details of that kind are very important.

But what I want to emphasize is, taking the present principle of construction of the electric lamp, and the limiting factors with

regard to its use in the pit, there is no royal road by which we can increase the available light two, three, or four times. Until a genius comes along, the improvements must be in matters of detail.

Then I would like to say a word about the flame lamp. The possibilities of improvement on the present lines are limited in that too, I think. We have lamps now which will give anything up to 2½-candle power, but necessarily, I think, those lamps are more complicated in design than the old simple Mueseler, and more liable to go wrong, as well as, in certain circumstances, more liable to go out. There is also the rather serious defect of liability to over-heating. Again, the size of the lamp is limited, and with the more perfect combustion of the oil, which is contingent on a better light, the over-heating is a considerable difficulty to get over. Some of the experimental lamps we have now got in hand get so hot that, after they have been burning a short time, especially in sluggish air, they are too hot to be held. Of course, there may be possibilities in the direction of using acetylene for lamps; there is no safe acetylene lamp at present.

There is only one other point I would mention, and that is one on which Mr. Elworthy lays some stress, and Dr. Llewellyn also mentioned it. I refer to the question of the reflecting power of the surfaces surrounding the lamp when the lamp is in the pit. The black coal face absorbs anything up to about 90 per cent. of the light, a very large proportion. Speaking in the terms of a fairy-tale, if that coal face could be turned into white coal, I think the electric lamps we have at present got would be amply sufficient. The question is—and it is entirely one for the practical men of the pit—whether it is possible, as an experimental measure to start with, to carry further the whitewashing which, I think, is carried out now in a good number of pits, to whitewash the pit bottom, and, perhaps, along part of the road. I know the practical difficulties are very great, but so also would the results obtained be very great. The effective illumination in the pit would be greatly increased by even a limited amount of whitewashing, more than by doubling the power of the lamps. It is a matter for the practical men to consider, whether there is anything more they can do in that direction.

One more word. As the Committee, of which I am Secretary, evolves experimental types of lamps, they propose to apply to them—provided they are safe—the only proper test which can be applied, namely, the test in actual pits; and if there is a colliery agent or a colliery manager here who would care to co-operate with the committee in that work by giving a careful trial in their pit to an experimental lamp, I shall be glad to get into touch with him, and I have no doubt we can do some business.

Mr. Hailwood: In talking of the electric lamp and the benefit to be expected from it, it is singular that in one division of Yorkshire there are 69,341 electric miners' lamps, and they are apparently not giving such a good result as one would expect. Otherwise, I cannot understand how it is that the Manager of the Coal Owners' Mutual Indemnity Society, in giving evidence before the Compensation Committee in 1919, stated that the number of nystagmus cases had advanced from 30 in 1907 to 515 in 1918, and that at a period when there is such a large use of electric lamps. I should have thought the number of cases would have gone down. So it makes one wonder whether the electric lamp is the remedy.

Another peculiar thing is, that in the country there were 156,521 electric lamps in use in December, 1918, and we have 90,200 of the combustion-tube type with a candle-power of 0.99. The collier uses his lamp roughly, and for that reason we cannot give the maximum efficiency. In the particular case we had a narrow slit, through which the flame passed, and subsequently we opened the slots because we could not get the proper attention to the lamp in the lamp-room, nor could we get the miner to realize his lamp was worthy of a few moments' attention. I think there should be a little education of the miner in these matters from his own Federation. As they are considered to be skilled men, one would suppose they would be educated up to the essentials of their own trade. Taking 156,000 electric lamps, giving apparently one candle-power and 90,000 combustion-tube lamps, it leaves 499,985 lamps of other kinds in the country. One would think the number of cases of nystagmus would go down if better illumination is the principal remedy. But it has gone up from 4,500 to 6,000 cases, and since the war the cases are jumping up in number in a peculiar manner. When I heard this paper was to be given, I wrote round to our customers. We have 192,000 lamps; one-third of the lamps belong to us. We got replies from 136 pits, which have in use partly combustion-tube lamps, partly oil. Forty-one pits report no cases of nystagmus, 26 pits reported a reduction of cases of nystagmus, while 46 pits reported increases. But what astonishes me is the great variation in the numbers of cases, even at pits not more than a mile or so from others. I have 2,835 lamps in one group, and 90 cases of nystagmus are reported there. In another pit, within three or four miles, there are 1,058 similar lamps, and they have two cases of nystagmus. Take another pit, five miles from there: 2,477 lamps, six cases of nystagmus. Another has 1,100 lamps and 26 cases of nystagmus. There are other parts of the country where large numbers of lamps are in use, and the cases of nystagmus number only one or two, and I speak of identical lamps. If defective illumination is the principal reason, I cannot understand why the figures of nystagmus do not run better together

—why there is not a steadier proportion. My opinion is that there must be something besides illumination having a bearing on this matter, though illumination may be an important factor. Men I have spoken to who work in hot dusty pits express the opinion that dust getting up their nose and irritating the canals of the nose, affect the eyes, and this may be an important factor. One notices how many people are wearing spectacles compared with former times. A manager who was at a local school said: "It is singular that in the school to-day the doctor comes and orders spectacles in a large number of instances; but as soon as a man goes to the pit, he discards his spectacles, and one would think that was a fitting line to enquire on." In some districts, where the pits are hot, and the men come from their work soaked in perspiration, they can be seen in the open air above wearing only a thin cotton vest or shirt, and they make no effort to protect themselves. I do not know whether it is from sheer bravado. If nystagmus is, as the doctors say it is, a nervous disease, surely there should be some protection from extremes of temperature.

Mr. J. George: I represent a lamp firm, and I have listened very attentively to the medical side of the question. I also speak as a practical miner, as one who has been brought up, from boyhood, in the pits, and has risen to the post of colliery manager. In the beginning of the world the cry was for light, and we are still crying for it. We have various grades of light now; we have the electric lamp, but I make bold to say we have never moved an inch from the fundamental principles given us by Sir Humphry Davy. One interesting point raised was, that the electric safety lamp hurts the men's eyes. That is so. But let us look at the further side of the case. Dr. Lister Llewellyn talks about men not seeing the sun. I often went down the pit at 6 in the morning and did not come up again until 6 at night. I worked in an open lamp pit at that time, and when I came out my eyes were sore if the sun shone in my eyes. What hurt the eyes was not the sun, but the long confinement in the pit. If men suffer from the electric safety lamp it is not due to the lamp, but to the men's eyes having previously suffered from an indifferent light. I listened with rapt attention to the last speaker, and I could give you instances from a town in Lanarkshire. There are two pits, (a) in an open lamp district, and (b), in a safety lamp district. If you look at the faces of the men working in pit (a), those working with the open light and compare them with the faces of the men in the safety lamp pit, you will see that the faces of the men in the safety lamp pit have the eyes drawn, and those are the men who have not been reported as having nystagmus, but they are in the early stages of it. I have to wear glasses now because of having suffered from nystagmus. In Scotland we call it the "clanny blink."

I would like to call attention to the extra combustion which is going on all over the pit which uses oil lamps, as compared with that when electric lamps are used. Take a colliery using, say, a thousand lamps, and think what that extra combustion means in using up all that oxygen in the burning, meaning, of course, a double supply of carbon dioxide in the pit. Miners with nystagmus must take much of the blame themselves. Men are afraid to touch the lamp in case it goes out, and they try to see to work when there is practically no light.

I was very pleased to hear Mr. Armitage say what he did. Where electric lamps have been installed I am sure, from my experience and from what my friends have told me, that accidents have been considerably reduced. And electric lamps do not cost more than others, the cost is about the same. The miners themselves prefer the better light of the electric lamp. In one district in Scotland the miners can have the best oil lamp to go down with for nothing, but they prefer to pay 9d. per week and have the electric lamp. That will show you what an advantage it is.

Mr. D. Leighton Davies (Cardiff): Speakers have emphasized he point that nystagmus is part of a general nervous disease, but it is difficult to understand how a deficient light can affect the general nervous system, cause the tremors, the restricted visual fields, and so on. I feel that there must be some other cause producing what we speak of as miners' nystagmus, of which the eye symptoms are a small, but a very important part. I think it is possible that the disease is a poisoning, due to emanations of gases from the surface of the coal, it may be in the form of hydro-carbon, or it may be some other factor which has not yet been discovered. Or it may even be micro-organisms. What are the proofs, or the evidence, on which I say this?

First of all, the mines which are least gassy, those in which a naked light can be used, are those in which nystagmus is rare. And I think this is due to a diminished amount of gaseous exhalations from the working face. Those men who are working at the face of the coal, where, at any rate, ventilation is less perfect than elsewhere, are much more frequently attacked with nystagmus than are others who are working in better ventilated areas, such as hauliers. It has been shown, by many observers, that nystagmus is more prevalent in some places, and at some seasons, than others. May not this be due to a difference in the transfusion of noxious materials? Nystagmus is rare in those who have worked only a short time underground. But when it does occur in those cases, the nervous symptoms are very prominent, as if they were very vulnerable to the conditions obtaining in the pit. It is a case of chronic poisoning, with the occasional incidence of a more acute type.

A very interesting point concerns the visual fields. Mr. B.

Cridland has pointed out that many of the cases showed a concentric contraction, and that the fields for blue and red are more contracted, in proportion, than the white. For a long time past I have carried on investigations into the visual fields in cases of chronic poisoning caused by the presence of pus, such as in cases of bone abscess, and I have been struck by the fact that in such cases of chronic auto-intoxication there was a marked concentric contraction of the visual fields, and the field for colour was more contracted than that for white. So that the field in miners' nystagmus is the same as that attending poisoning due to other conditions. If the theory is true that nystagmus is a neurosis produced by chronic poisoning, how are we to explain the number of cases of nystagmus diminishing in the better-lighted mines? I think this can be explained in the following way:

The movements of the eyes cause less inconvenience to the miner suffering from nystagmus under moderately good light than when the intensity of the light is diminished, or than when it is particularly brilliant. But, although these symptoms are less troublesome, the nystagmus has not disappeared. And this may also occur in the better-lighted mines. But the man still has nystagmus. This possibly may be explained by the fact that when he is not in the presence of good daylight, he has to focus with the peri-macular region, and so nervous disease comes in and upsets the balance, and so the nystagmus becomes more marked. Therefore when the miner who has nystagmus is supplied with a better light, he will be able to carry on his work, in spite of his nystagmus, because I think it has yet to be proved that improved light diminishes nystagmus. All it does, I think, is to allow more men to go on with their work. A large number of men are continuing work now in spite of their nystagmus.

Mr. Harrison Butler (Coventry): It is unreasonable to expect the introduction of better lighting to produce an immediate reduction in the number of cases of nystagmus. Miners' nystagmus is a disease which may take ten to twenty-five years to develop, and if we are going to improve the lighting of our mines, it will be, perhaps, ten years before the nystagmus curve shows a marked fall. Mines are, I believe, full of men with eyes in the pre-nystagmus stage, and to them, the introduction of a bright light will increase their nystagmoid indications at first. Because one of the early symptoms of the condition we are discussing is photophobia; a man who has been working with an illumination of, perhaps, one-tenth of a candle-power, will at once have to give up work if faced with a brilliant light, and this will make the improved lighting appear not to have any effect.

Dr. Shufflebotham has just said it is only this year that the question of miners' nystagmus has received full recognition. But

I would point out that as early as 1912, I introduced a discussion at the Oxford Ophthalmological Congress on the subject, and very many of us have drawn attention to the fact that the eye symptoms are only a part of the disease; it is a general nervous disease. And—I think owing largely to that discussion—the Government scheduled eye twitching as a disease, one which could be registered, and in respect of which the men could claim compensation as for nystagmus.

Dr. Harford (London): I have taken an interest in this disease because, during the war, I had medical charge of a Division in which were a large number of men from the mines of Yorkshire, Cumberland, and Durham. And I have published, in the *British Medical Journal*, a strong corroboration of the facts which Dr. Llewellyn has brought out this evening. I emphasized the opinion that it has been a misfortune that this disease has not been sufficiently dealt with by the neurologist, apart from the ophthalmologist. And, on looking at the text-books on medicine, it is remarkable to find such an important disease as this hardly mentioned in some of them. I have received from Dr. Christie Reid, of Nottingham, a letter in which he says he was much struck, when in the mining district of North-Eastern France, with the complete ignorance of the disease, though, from conversation with the miners, he ascertained that their methods of getting the coal were much the same as ours. He wrote, on his return, to the Manager of the Briey mines, and he replied that many were familiar with the disease, but since the introduction of electric hand lamps the disease has been eliminated, and is now practically unknown. And he says, "Why can't our colliery authorities do likewise?" He speaks of his attempts to get electric lamps introduced into the Notts. and Derby coalfields, but the only result has been to secure that a few individuals with severe nystagmus shall have electric lamps. That is tinkering with the matter.

I have not had the advantage of dealing with this subject on the spot, but I have carefully studied the literature of it, and I have no doubt the condition is due to faulty illumination chiefly. Still, as one speaker said, there are numerous subsidiary causes, especially the fact of accidents occurring to the head, quite apart from the defective eyesight; also the other conditions which lead to impaired health.

The most important case I had to deal with was a man who apparently had got into the Army in the ordinary course, having passed the tests. When he came to me, however, he was a hopeless invalid. The sight of this wreck of humanity in the hospital convinced me of the great importance of the disease, and impressed me with the fact that every one of us who takes the least interest in it ought to use every possible influence to get the matter

dealt with. And it has been clearly demonstrated that illumination which is sufficient is the great point. As to why we should sometimes get results which are apparently contradictory, I would point out to those who are not medical men that the diagnosis of different diseases is not an easy matter, and that difficulty is present in this case. There are, I think, many people who are suffering from the disease in a variety of forms, but whose case is never diagnosed. We know of more cases than previously because there is now greater interest aroused in the subject, and, as more are acquainted with the facts, cases are more generally recognized than formerly. And, as has been said, statistics may not at once show the benefit of the reform. I think there should be such attention devoted to this matter that it should be considered as much a reproach to have a case of miners' nystagmus as it is for a match maker to have a case of "phossy jaw." When the submarines were making havoc no one said, or was allowed to say, "We cannot deal with these submarines." The Navy expert said, "You must deal with them." And now that we have this disease (miners' nystagmus) having such a tremendous effect on the men, it ought to be imperative for reform to be taken up; and I hope a result of this meeting will be that very strong action will be taken to deal with it.

Mr. V. V. Pass: In reference to Dr. Llewellyn's remarks concerning the need for lamps of 4-candle power, I think Mr. Fudge pointed out the chief difficulties which stand in the way of that. From some sources we have the statement that the present lamp is safe, from other sources it is said it is not. In regard to a 4-candle power lamp, the weight is the main difficulty, but if a satisfactory electric bulb could be got, such an electric lamp would very much improve matters. We have got over 67,000 lamps in the South Wales district, and the greatest punishment you can inflict on a miner who has once used an electric lamp is to make him use an oil lamp, even if it is only for a day.

Mr. G. H. Pooley, (Sheffield): One point to remember is, that the miner usually goes on working until the last moment that he is capable of doing so, because he likes comfort, and does not want to have to be content with a sum which is about half his regular wage. Hence many miners continue working although they know they have nystagmus: they work until they virtually drop at the coal-face.

In my opinion, miners' nystagmus must be due to some instability of the cerebral centres, caused by the defective illumination under which the miner has to work, and, though to an unknown extent, by impurities in the atmosphere in which the men work. For it is when working in the outlet air, in which the lamp gives a poor light, that the cases of nystagmus most frequently occur. And this impure air is breathed by the man. Our information is not yet full enough

to allow us to estimate the effect of prolonged inhalation of small proportions of coal gas.

Dr. Llewellyn has carefully estimated the amount of illumination, and I agree with his findings. All that he has published in his book in 1912 has been found since to be correct. The instability I spoke of I believe to be due to the prolonged exposure of the miner to these conditions, but the symptoms remain in abeyance for a long time, and they are exacerbated when activated by a shock or by bad health. This may happen even when the collier has been away from the unfavourable conditions for some time. For instance, men who enlisted and went off voluntarily into active service, and had been previously working regularly five days a week at the coal face, when they went back to this work after coming back from the war, broke down with active miners' nystagmus, and in a bad form. The collier works in such feeble illumination as to require the special adaptation of his eyes to it, and in these circumstances the macula becomes a "blind spot."

I think the question before you is, can the illumination at the coal face be increased, not simply by improving the lamps at present in use, but by introducing something 60 times as great? At the present time they are employing electrically-worked coal-cutters at the coal face, and I have been wondering whether it would be possible to light up the coal face with the electricity which runs that machine. I am not an electrical engineer, but possibly something along those lines could be worked out.

Dr. Ettie Sayer (London) advocated experiments with yellow light. She fully agreed with the speaker who talked about poisoning in the mines. Writer's cramp is due mainly, of course, to the writing, but if the patient has septic teeth it comes on quicker. Similarly, if the miner has a toxic condition due to his work, he is more liable to develop miners' nystagmus.

Mr. Bernard Cridland (Wolverhampton): I think when we speak of miners' nystagmus as a disease of the nervous system we ought to go further, and be more scientific: we ought to speak of it as a disease of the ocular part of the central nervous system, for I feel sure every sign and manifestation of the disease can be referred to the ocular centres—I mean the whole ophthalmic apparatus. It may be toxaemia, it may be fatigue, or what not. Every symptom, however apparently unconnected, can be traced to action on the higher ocular centres with the other centres of the brain.

I am interested in what has been said about acetylene lights, and I had intended asking whether it would be possible to use them.

And I would particularly like to ask whether this discussion is going to be allowed to end here, namely, by being simply recorded in the journals of the societies concerned. Has not the time arrived when we ought to have some sort of joint committee,

consisting of representatives of the Illuminating Engineering Society and the medical profession, and ask that committee to draw up some sort of report, and thus get an idea of the lines along which research can most profitably be undertaken? From the ophthalmic side, we have already got the needed machinery ready. With great respect to the Ophthalmic Section of the Royal Society of Medicine, I suggest that the Council of British Ophthalmologists, as representative of British Ophthalmology in general, is the body to be approached with a view to their appointing representatives on such a committee. And I suggest that they would not appoint only ophthalmic surgeons, but any who are interested in the disease and have a knowledge of it. If success is achieved, it will be a great national investment. Such a report, when drawn up, should be sent to the Home Office and other Government departments. Perhaps that would be one more stimulus to the taking of further action in so important a matter.

Mr. A. L. Whitehead (Leeds): I am very deeply interested in this question, working, as I do, in the district from which Mr. Armitage comes.

We all realize that this is a very complex problem; it is not just one single factor which is at work. I think Dr. Haldane hit off the trouble when he said it was due to the miner trying to see his work under disadvantageous conditions. This difficulty in seeing may be due to any of a number of causes; to some error of refraction, to some dust in the mine, to inhalation of coal gas. But the most important thing is, that he must have light to see with, and obviously, our first duty is to increase, in every possible way, the illumination at his work. Although Dr. Llewellyn's figures seem to show that if you increase the light by half a candle power you can cure the nystagmus, I do not think I can follow him as far as that. Still we must increase the illumination.

The practical point seems to me to be, as Dr. Llewellyn said, the portable light, a head light preferably, which the man can direct on to his work, and increase the power of that light by the provision of adequate reflectors. We increase the light-power of our motor lamps by reflectors, and to an extraordinary degree, and, instead of having lamps which distribute their illumination in all directions, we ought to concentrate it. I think that must be the key-note in the mining of the future.

Mr. N. Bishop Harman (London): Dr. Llewellyn showed an excellent head-lamp arrangement, but I would like to ask how far is it safe? He knows the rough usage these lamps are submitted to in the miner's hands. Lamps should be severely tested in the testing department before being used in a highly dangerous mine.

With regard to the weight, everyone has talked about the development of the electric light on the lines of the filament.

When I was at the Cavendish Laboratory, Cambridge, we were shown a vapour lamp which gave a lovely light; it could be looked at as long as one liked without injury. And we have seen the other extreme, the mercury-vapour lamp. Why cannot the engineer get us a lamp of that sort? Nothing will convince me that the mercury-vapour lamp can be looked at comfortably. Surely there is an electrical genius who is able to do something in this way for the miners? I confess I have been quite disappointed at the tone of this discussion. I had expected to see this evening demonstrations of improvements which I had hoped might by this time have been achieved. We have now learned the reasons why there are not such: there is still debate as to the cause of the condition. But surely, since Sir Josiah Court wrote, there cannot be any doubt; his papers on the subject are most convincing. And it has not been disputed that in mines where the safety lamp is used, nystagmus is most prevalent, and where it occurred in the others, the victims were those who had previously been working in dangerous mines. On the continent this fact was recognized, and it was attempted to give the credit to one of their own countrymen. You have heard what Dr. Harford said, and that is no doubt confirmed by what occurs in other countries too. Cannot somebody start a research with the object of producing a golden-vapour lamp which can be produced by a small battery, one which, though of small weight, shall yet have sufficient illuminating power? If you can do that, it seems to me that the problem is solved.

Mr. Leon Gaster, Secretary of the Illuminating Engineering Society: We have a series of other interesting contributions, which will appear in the *Illuminating Engineer.*

I wish to thank the exhibitors for their kindness in showing us their further developments. The effect of Mr. Fudge's remarks is to increase the encouragement the Society feels in seeking further co-operation on all points connected with light. The Home Office has shown a keen spirit of co-operation. If we can show that it will be useful, the Mining Department of the Home Office will take advantage of any assistance offered. The idea of forming a Joint Committee has already been mooted, and I hope to convene such a Committee.

Dr. Lister Llewellyn (in reply): I want to call the meeting's attention to the fact that when the meeting started two oil lamps were lit. They are now both out, yet they have not been touched.

I would insist that the standard to aim at is to get a light in a safety lamp up to the standard of that in the naked light pit, and to do that, you must have either a 3- or 4-candle power lamp, or bring the light nearer to the coal face which the man is working on. If you do the latter, on account of the great law of inverse squares, you increase the light used in a manifold degree. I think the

solution of the problem lies in the universal introduction of the cap-lamp: which weighs 2¾ lbs. and gives a large area of illumination. I do not think there is any danger of burning. Both battery and cap are locked. It would give a light five times as much as at present. In the coal mine you must either increase the power of the electric lamp, or you must bring the light nearer. This lamp gives a broad illumination, there are no shadows, and as the light does not fall on the eyes, the worker feels no glare. (Two speakers here expressed an opinion that the lamp was not safe.) I do not think there is danger. These are used in America largely. There is no greater danger with this than if the miner falls on one of the other lamps. (I have exploded gas with them.) More explosions have been caused by oil "safety" lamps than by anything else.

The Chairman: I feel constrained to say that the great difficulty is connected with the lamp, and I came here in the hope that that had been overcome. I have no doubt whatever that the difficulty in regard to the incidence of miners' nystagmus is the small illumination, and I think Dr. Llewellyn has proved that conclusively: that the remedy consists in getting a safe increase in illumination, in some way, either by direct, or by reflected illumination. I do not know anything about the practical details, or how far it is feasible. From the scientific point of view, it is a very difficult matter to devise an electric lamp which shall be absolutely safe in fire-damp. Dr. Llewellyn gave me the impression that that had been safely accomplished, but I am not convinced yet.

Many of the speakers this evening must have curtailed their remarks, owing to the feeling that they were standing in the way of others, and I want to say I hope they will expand them for publication, as this is a very important discussion. And if there are any here with views and they have not spoken, I hope they will send their remarks to the *Illuminating Engineer* for inclusion. I think this discussion may be of some considerable practical importance in supporting any action which may be taken by the Home Office, or in promoting such action as may be considered desirable.

ANNOTATIONS

The Teaching of Ophthalmology

The vexed question of the teaching of ophthalmology is discussed in three papers read before the October meeting of the Section on Ophthalmology of the New York Academy of Medicine, by Dr. F. H. Verhoeff, of Boston, Dr. M. Wiener, of St. Louis, and Dr. A. Duane, of New York, respectively. They are published in the January number of the *Archives of Ophthalmology*. Verhoeff deals

with the undergraduate and the graduate; the other two with the graduate alone. Verhoeff divides those who require instruction into four main groups: (*a*) undergraduates; (*b*) general practitioners desirous of taking up ophthalmology; (*c*) practising ophthalmic surgeons desirous of perfecting their knowledge; and (*d*) recent medical graduates desiring to qualify themselves for the practice of ophthalmology. (*a*) As regards this group, Verhoeff refuses to take seriously the undergraduate course in ophthalmology, and contents himself by suggesting that students should be given such a comprehensive, though general, view of the subject that they will come to recognize what an interesting branch ophthalmology is, and that its mastery requires a knowledge of all the fundamental principles of medical science. (*b*) When post-graduate schools of ophthalmology, worthy of the name, are established, the men in this group should be compelled to take the complete course provided. In Verhoeff's opinion it is not desirable to enter upon general practice before a man begins the practice of ophthalmology. (*c*) For the benefit of these men courses of short duration might be arranged, possibly limited to the summer months. (*d*) The first requirement is the institution of proper schools, and the author outlines a plan for such a school. For admission he would require a degree from an approved medical school, which should imply courses in higher algebra, plane and solid geometry, trigonometry, physics, and chemistry, and practical clinical experience in general medicine and surgery, as well as in certain special branches as neurology and dermatology. A reading knowledge of French and German would be an advantage. The course at the special school would extend over two years, and would lead to the degree of Doctor of Ophthalmology (Oph.D.). The first of these years would be devoted both to clinical and laboratory work, while during the second the candidate would act as an assistant or a resident in an approved hospital. Verhoeff advocates small classes, each consisting, perhaps, of only eight students, and since the fees paid by students would be inadequate for the maintenance of such a school as he outlines, he suggests that the money necessary should be obtained from the public. Wiener, who confines his remarks to the graduate teaching of ophthalmology, enters a vigorous plea for the necessity of a thorough grounding in medicine. He lays stress upon the teaching of a systematic method of examining patients, and the development of the powers of observation; the necessity of records, and the proper ways of keeping and of indexing them should form important items of instruction. The tendency of Americans to go to foreign clinics and universities, he explains by the high degree to which specialization was carried, especially in Germany, so that the student could obtain whatever he stood in need of at almost any season of the year. He suggests

that some of the more important institutions in America should group and open highly specialized courses to the many desirous of equipping themselves to practise ophthalmology to the best advantage. Duane also takes up the case of the graduate teaching, and advocates: (1) thorough drill in the theory of each branch of ophthalmology prior to taking up its practical application; (2) instruction in methods and the general principles of aetiology and therapeutics; (3) the supreme importance of individual instruction. Small classes should be formed, each consisting as far as may be of men of approximately the same ability and training. He attaches importance to "Quizzing," alternating with lectures and frequent "short, snappy reviews." Finally, he sketches an intensive ophthalmological course, designed to cover four months.

The Council of British Ophthalmologists

We call the attention of our readers to the notice of a general meeting of all British ophthalmologists to be held at 4 p.m. on Friday, 30th of April, at the Rooms of the Royal Society of Medicine, to receive a report of the work done by the Council of British Ophthalmologists since its inception two years ago. The formation of such a body was first proposed in our columns, and its reports have all been published in full in our pages, so that our readers can form some idea of the work that has been done by the Council since its foundation. The published reports deal with the "Standard Illumination of Test Types," "The Education of Medical Students in Ophthalmology," "The Need for a Higher Qualification in Ophthalmology," and "The Vision of Drivers of Mechanically Propelled Vehicles." The preparation of these reports represents only one part of the Council's work. As its existence is becoming more generally known and its functions more fully recognized, an increasing amount of work of an advisory nature is being referred to it by various public bodies. We believe that the Council in its short existence has already done valuable work, and that an ever widening path lies before it, and we hope that everyone who can will attend the meeting on the 30th of April, so that the Council may feel that it has the support of the general body of ophthalmic surgeons in the country behind it.

Miners' Nystagmus

An interesting discussion on this subject, so important both from the medical and the economic standpoints, was held at the Royal

Society of Arts on February 24, with Mr. J. Herbert Parsons in the Chair. We are indebted to the courtesy of the Illuminating Engineering Society for permission not only to reproduce in full the communications of Dr. Lister Llewellyn and Mr. Elworthy, but also to publish abstracts of the remarks of other speakers. The full report will appear in the *Illuminating Engineer*. In spite of some divergence of opinion on details there is a consensus in favour of the view put forward by Sir Josiah Court, and so ably supported by scientific evidence by Dr. Llewellyn, that the prime factor in the production of the disease is deficient illumination. The problem of overcoming this defect in mines cannot be insuperable, and there is reason to think that the Government authorities are convinced as to the imperative necessity for solving the problem at the earliest date. Ophthalmologists will willingly participate to the best of their ability in bringing about so desirable a result.

ABSTRACTS

REMEDIES

(1) **Weeks, John E. (New York).—Tuberculin in diseases of the eye.** *Trans. Amer. Ophthal. Soc.* Vol. XVI. (1918), p. 114.

(1) **Weeks's** paper was written chiefly for the purpose of exciting a discussion upon tuberculin in diseases of the eye, and, apart from its intrinsic value, it succeeded admirably in its object. As regards the diagnosis of a tuberculous process in the eye, Weeks has found the best method to be by injecting subcutaneously $\frac{1}{2}$ mg. in children and 1 mg. in adults. The injection is repeated, if no local reaction is obtained, 48 to 72 hours later, provided the patient's temperature has remained below normal for the preceding 24 hours. Two mg. are employed for the second injection, and 3 mg. for a third injection if a satisfactory reaction has not been obtained from the smaller dose. In some circumstances it may be justifiable to use a larger dose. The author has no experience of cases where the condition of the eye was made worse by the diagnostic injection of tuberculin. On the contrary, the condition of the eye after the reaction has subsided is better than before tuberculin was injected. In many cases it is desirable to make the

diagnostic tests for syphilis as well as for tuberculosis, and, when both yield positive results, to institute treatment for both diseases at the same time. *In what cases of eye lesion should tuberculin be given?* First, all cases where a local reaction is excited by the injection of test doses of tuberculin, and, secondly, suspected tuberculosis in which (*a*) a general reaction to tubercle has been obtained, or (*b*) benefit has accrued from therapeutic doses of tuberculin. *What kind of tuberculin can be used to the greatest advantage in diagnosis and treatment?* Weeks employs the old tuberculin as supplied by the New York Board of Health in almost all cases, but when improvement ceases he resorts to the use of one of the other preparations, sometimes T.R., sometimes B.E. *In what dose and for how long should tuberculin be used in treating tuberculosis of the eye?* A dose is employed just short of that sufficient to produce a systemic reaction, and is repeated every four or five days. The time over which the treatment should extend can be fixed only approximately. Weeks continues the injections for at least two months after all signs of activity of the tuberculous process have subsided, and recommences if any sign of relapse is found.

In the discussion, **Risley** (Philadelphia) mentioned a case of gumma of the orbit, in which mercurial treatment had done no good. Tuberculin (which gave a positive reaction) seemed to have cured the condition. **A. E. Davis** (New York City) preferred old tuberculin for therapeutic purposes. **Woods** (Baltimore) spoke of cases where tuberculin seemed to have done harm by starting fresh mischief in the fundus. **Byers** (Montreal) regarded 1 mg. of T.O. as too high for an initial dose. His own preference had always been for a freshly prepared bacillary emulsion. **Jackson** (Denver) preferred the old tuberculin for treatment as well as for diagnosis. A dose should not be given oftener than once a week. He had seen fresh intraocular haemorrhage on three separate occasions follow tuberculin. **Ziegler** (Philadelphia) used small doses of old tuberculin. **Verhoeff** (Boston) had now entirely given up tuberculin as a therapeutic agent. He depended on simple hygienic measures.

S. S.

(2) **Guibert.—The treatment of corneal ulcers.** (**Traitement des ulcères de la cornée.**) *La Clin. Ophtal.*, June, 1919.

(3) **Guibert.—Subcutaneous injection of cow's milk.** (**Injections sous-cutanées du lait de vache.**) *La Clin. Ophtal.*, June, 1918.

(2 and 3) In these two articles **Guibert** deals with various forms of paraspecific serum therapy as concerns corneal ulcer; and with

the general good effect of subcutaneous injections of cows' milk, which act after the same fashion as paraspecific serum therapy.

ERNEST THOMSON.

(4) **Dor, L. (Lyon).—The medical treatment of cataract. (La traitement medical de la cataracte).** *La Clin. Ophtal.*, June, 1919.

(4) Dor, in treating cataract by medical means has settled down to the use of a mixture of chloride of calcium and iodide of sodium. He puts more faith in the calcium than in the sodium, but as a matter of fact the mixture results in iodide of calcium, at any rate, to a certain extent. The formula is:

Crystalized chloride of calcium	4 grammes
Desiccated iodide of sodium	4 grammes
Distilled water	500 grammes

The patient is instructed to bathe the eyes for twenty minutes every day for three months, then for two months out of three, then for one month out of three, and so on for one month out of three or four for the remainder of life. Put shortly, the theory of the treatment is dehydration of the lens, since in some cases, at any rate, cataract is caused by absorption of water by the lens. Dor apologizes, as it were, for not giving his notes of cases, but records it as his opinion that "the evolution of cataract treated as thus advised is undoubtedly retarded in a very large number of cases, and often for a very long time." In addition to the treatment, it is necessary to say that Dor advises the patient to pay very particular attention to his stomach and teeth, and in particular not to retain upper molars affected by periostitis.

ERNEST THOMSON.

(5) **Terrien, F. (Paris).—Radio-diagnosis and radiotherapy in ophthalmology. (Radio-diagnostic et radiothérapie en ophtalmologie.)** *Arch. d'Ophtal.*, May-June, 1919.

(5) At a meeting of the *Société française d'Ophtalmologie* in May, 1919, **Terrien** presented a report on the "Employment of Radium and X rays in Ophthalmology." He had as a collaborator on the technical side M. Ledoux-Lebard. The present paper is supplementary to the report and is written in order to give more precise and detailed information on some of the points referred to in the report and concerning which there was some discussion by the members.

In this paper Terrien deals systematically and at considerable length with the radiography of the normal and pathological skull, the cranio-cerebral topography, the diagnostic and prognostic value of alterations in the sella Turcica and adjoining parts, and the use and method of application of radium and X rays in tumours in the

pituitary region. Even a brief synopsis of this would occupy much space and would be unsatisfying. He makes remarks on the " action of X rays and radium on the normal eye," which are important and worthy of quotation: " In spite of somewhat contradictory statements which have been published, X rays and radium appear to exert but little injurious effect upon the normal eye. The only lesion clearly attributable to them is conjunctivitis which may follow too prolonged exposure; it is an affection of the mucous membrane corresponding to the radio-dermatitis occasionally met with. In contradistinction to the recorded observations of Birch-Hirschfeld we have never seen lesions of the cornea, the crystalline lens, or the retina in numerous experiments conducted in association with three other observers. The only instances in which conjunctival lesions resulted occurred when unfiltered rays were used. We may feel confident that the rays are generally well tolerated, with the exception of rays of low penetrating power. They do not induce any change in the transparent media, and the sclera will stand intense and prolonged irradiation without injury. Even the delicate retinal tissue appears resistant, and it would seem that the dangers of radio-therapy to the normal eye have been exaggerated."

J. B. LAWFORD.

(6) **Sauvineau.—Antigonococcic vaccine and the complications of blennorrhagia.** (**Le vaccin antigonococcique et les complications de la blennorrhagie.**) *La Clin. Ophtal.*, August, 1919.

(6) **Sauvineau's** remarks are based on one case, but this case is a very striking one in which a young man suffered from gonorrhoeal conjunctivitis complicated with articular troubles of a severe type. In the course of treatment by the family physician the conjunctivitis was hanging fire, the cornea was becoming affected, and the joints were threatened with ankylosis. Sauvineau advised the employment of the Nicol and Blaizot vaccine (Dmégon)*, with the practically immediate result that the whole infection was subdued with *restitutio ad integrum* of the articulations.

ERNEST THOMSON.

(7) **Darier, A. (Paris)—Biological methods of treatment.** (**Les médications biologiques.**) *La Clin. Ophtal.*, October, 1919.

(7) **Darier** is indefatigable in his insistence on the value and benefit to be derived from the use of sera and vaccines, more especially by means of their paraspecific action. In this article he keeps us up to date in a review of these and also of the modern methods of injections of peptones, albumoses, and cow's milk in infective

* For an abstract concerning these vaccines, see *British Journal of Ophthalmology*, 1919, p. 182.

conditions. Darier has all along been a strong supporter of the paraspecific action of antidiphtheritic serum, and, while giving due weight to other methods, he seems to have the greatest faith in this. The following sentences may be transcribed as appearing to give the author's crystallization of his experience:

"It cannot be too often repeated that an injection of antidiphtheritic or plurivalent serum has on general infections a therapeutic action as powerful as that of peptones, milk, and colloidal metals, and without any appreciable rise of temperature. Here, as always, it is a question of the kind of case we are dealing with. Such and such a one of these agents will have a more marked action, perhaps even a specific action, in certain individuals under certain conditions. Clinical observation must assist us in each case which agent to choose. Further, most of these agents, far from being irreconcilable rivals, can by their combination or alternation give excellent therapeutic results." Again, says the author: "In all infections, whether influenzal or otherwise, the exact nature of which has not been determined and while waiting for a bacteriological diagnosis, one may be able by the administration of a draught containing 20 cc. of antidiphtheritic or plurivalent serum accompanied by an injection of milk, to cause rapid abortion of the infective processes."

ERNEST THOMSON.

(8) **Pauly, Raymond.—The serum therapy of influenza.** (**Sérothérapie de la grippe.**) *La Clin. Ophtal.*, October, 1919, from *Lyon Medical*, March, 1919.

(8) This article has nothing whatever specially to do with ophthalmology, but is interesting, nevertheless, in association with the article by Darier in the same number of *La Clin. Ophtal.*, **Pauly**, like Darier, has come to recognize that the administration of a serum by the mouth has the advantage of simplicity combined with freedom from serum "accidents." He usually gave 10 cc. of a plurivalent serum in cold sweetened water, renewing the dose six hours afterwards. Often the improvement was manifest the next day when, however, he gave another 10 cc. Usually this was sufficient. While this was the method of choice, Pauly still employed subcutaneous injection in bad cases, or where vomiting was a prominent symptom. The author concludes with these words: "We have never seen any inconvenience from the employment of plurivalent serum, and the results obtained have made us believe in its real efficacy in the treatment of influenza, at any rate in the form of that disease existing at present."

ERNEST THOMSON.

BOOK NOTICE

On Inflammation of the Eye caused by Resorption of Crystalline Lens Matter in the Eye Lymph. (Over Ontstekingen van het oog veroorzaaht door oplossing van lensmassa in de oog lymphe.) By Professor M. STRAUB. Amsterdam: J. H. de Bussy. 1919.

This little book is not only another proof of Straub's unfailing diligence (he worked until his death), but is also a token of the love and friendship he inspired in the hearts of his former assistants, who, three years after his death, have edited with the utmost care this manuscript, as a sign of gratitude to their late master.

Straub's treatise deals with the toxic influence exercised upon the eye by lens matter in solution. Although this effect is well known, it is scarcely mentioned in text-books and periodicals, but Straub believes it to be of great importance, and according to his views, it often causes inflammation, which he calls phacogenetic, and, perhaps, even glaucoma. The treatise, which was meant to be part of a larger book, deals chiefly with phacogenetic inflammation, and touches slightly upon a new phacogenetic theory of glaucoma. Straub mentions the possibility that while a great quantity of lens matter may cause chronic or acute inflammation, even very small quantities continually penetrating into the fluids of the eye might exercise a slight irritation, and set up adhesive inflammation of the angle of the anterior chamber. In young people the lens matter is not at all toxic, or much less so than in the old.

The author has studied the action of dissolved lens matter in—

(1) Cases of cataract extraction and of traumatic cataract.
(2) Dislocations of the lens.
(3) Spontaneous resorption of senile cataract.

According to Elschnig, Uhlrich, and others, in eyes hitherto normal, after the extraction of cataract, an iritis or iridocyclitis may appear without infection, caused by the injury of the iris and the mechanical and chemical action of the lens-remnants. Straub believes that in such cases trauma and mechanical action are of little significance, but that the origin of the inflammation is to be sought in the chemical action of the remains of the crystalline lens. Even very small amounts of lens may cause inflammation, so that in most eyes posterior synechiae are to be found after the extraction of cataract, whereas in intracapsular extraction, or in very old people, where the lens leaves its capsule *in toto*, no synechiae appear. The writer observed on one occasion that in the eye first operated upon the expected inflammation occurred, while in the second eye there was no irritation at all after extraction. Straub explains this by immunity set up by the dissolved remains in the

first eye. He put his experience into practice in a second case, where the capsule was wounded during a preparatory iridectomy. The consequence was violent inflammation, which lasted for forty-eight days despite the usual treatment. Straub then practised the subcutaneous injection of a pig's crystalline lens suspended in sodium chloride solution. He intended to inject a human lens afterwards, but this was not necessary because four days after the first injection the inflammation began to lessen and the eye was soon quite well.

If Straub's theory is correct we can cure this kind of inflammation in traumatic cataract by extraction of the lens; although, if treatment by the method of injection of suspended lens matter proves to be effective, we can first get rid of the inflammation and then extract the lens, and in that way avoid interference with an inflamed eye. It is, therefore, necessary that we should be thoroughly well acquainted with the disorders associated with lens resorption, because a correct diagnosis, made in time, might save an eye that would otherwise be lost.

Straub shows in this book the course and symptoms of phacogenetic inflammation as taught by clinical cases and explained by microscopical examination. When the capsule has a slit in the anterior part we find signs of iridocyclitis, deposits on Descemet's membrane, oedema of the cornea, hyperaemia of the iris, and posterior synechiae. When the slit is in the posterior capsule, exudation is found in the vitreous. The diagnosis may possibly be confirmed by swelling of the limbus, which was observed in microscopical sections. The inflammation, as a rule, proceeds by fits and starts, and probably diminishes when the slit is closed and increases when it is open again. The size of the opening will determine the amount of lens-matter dissolved, and the degree of inflammation.

In a typical case exudation is found in and about the lens, in the iris, on Descemet's membrane, on the surface of the hyaloid cavity, on the retina, and around the retinal vessels. Those vessels are often surrounded by a thick girdle of lymphocytes, whereas the choroid is normal except at the ora serrata, where the vessels may also be enclosed in lymphocytes. When there is a break in the choroid more lymphocytes are found in the membrane. Straub thinks that the encircling of the retinal vessels by lymphocytes is of little importance, since clinically the retina may retain or recover its complete functions. For a similar reason Straub believes that the analogous infiltration found in the choroid in sympathetic ophthalmitis has no clinical significance, and that it will be necessary to revise the entire chapter of the pathology of that serious disease.

Straub further deals with the form and the size of the white blood

cells in these eyes. At the place of origin of the inflammation, where the largest amount of the toxin is present, we are accustomed to find polynuclear cells, and in this way the lens is histologically shown to be the cause of the disease. In some eyes the track of the polynuclear cells even guides us to the small spots where the toxins leave the capsule. The disease is neither a genuine cyclitis nor a hyalitis; both ciliary body and vitreous are invaded secondarily by toxins and white blood cells. In eyes with tubercle in the ciliary body we find a collateral hyalitis (Straub), and in the conditions under discussion we find the same, but the toxins emerge from the lens instead of from the ciliary body. As most of the membranes of the eye are infiltrated, Straub calls the disease *endophthalmia phacogenetica*. The cause of the resorption of lens matter may vary; in case 1 it was cataract extraction; in cases 2, 3, 14, capsular injury in iridectomy; in cases 7, 8 and 9 an injury; in cases 4 and 10, it was not known; in cases 5, 6, and 8, the inflammation appeared in the second eye some months after operation upon the first. It is probable that the capsule in old subjects, especially when suffering from cataract, is more fragile than in other eyes, so that slight causes are enough to tear it. Straub believes that in case 8, that of an English physician, a rent in the capsule of the cataract of the second eye was sustained during a rough crossing of the channel, and that this caused an inflammation which lasted only a few days. The treatment in such a case would be extraction as soon as the eye was quiet again or earlier, if the inflammation did not subside. Another possibility mentioned by Straub, is that where, in the eye that has been operated on, lens matter is resorbed, capsular matter may also be resorbed, and that the hypothetic substances which cause the capsular resorption also penetrate in the second eye and attack the capsular membrane.

The disease may often be found in blind eyes removed on account of pain. It is well to remember that the cause of pain in such eyes may be endophthalmia phacogenetica, because extraction of the lens may possibly succeed in saving the eye. Other causes of the disease named are dislocation of the lens and spontaneous resorption of cataract. Ask, in his excellent monograph on dislocation of the lens, publishes many cases of irritation caused by chemical action exerted by the lens, especially when the capsule was ruptured. Straub found this condition to be less frequent, since it occurred in only one of five eyes, the lenses of which were dislocated. Spontaneous resorption of cataract often causes eye disease, mostly while the process is active. In thirty-four cases von Reuss found inflammation in seven and glaucoma in seven. Peters, Harms, and others have also published complications of absorption of the lens. It is not certain that all the inflammations are set up by the lens toxins.

In some of the eyes examined Straub found atrophy of the lens and of the iris and ciliary pigment cells.

Straub believes that in cases of heterochromia iridis with cataract (Fuchs) the atrophy of the iris is secondary to the disease of the lens; the exudation cells take pigment from the iris with them, as we can see in the deposits on Descemet's membrane.

We have said enough to show that Straub's book deals with highly-interesting problems. It includes fifty-six splendid micro-photographs.

J. VAN DER HOEVE.

CORRESPONDENCE

OPHTHALMIC PHYSICIANS

To the Editor of THE BRITISH JOURNAL OF OPHTHALMOLOGY.

DEAR SIR,—In your annotation on my paper, the main object of the paper seems to have been lost sight of.

My paper is entitled, "The Need of Ophthalmic Physicians for the *Advancement of Ophthalmology*."

My argument is not so much that patients suffer from our want of medical knowledge or the want of surgical experience, but that the future progress of ophthalmology must mainly be dependent on *medical*, as opposed to surgical, research. There are so many questions we want answered involving medical research, and it is not sufficient for the ophthalmic surgeon to submit cases or questions to the physician.

The physician, in order to carry out research, must study for himself the ophthalmic problems and their allied conditions. It is no use our submitting allied questions to him. We shall never get any further on those lines.

Take the list mentioned in my paper: cataract, detachment of the retina, conical cornea, irido-cyclitis, etc. What chance is there for him to arrive at a conclusion as to cause, unless he is in a position to watch the case himself?

Dr. Ernest Thomson, in a letter to the *Lancet*, and many of my critics at the discussion on my paper, seem to find a special difficulty in the question of *Refraction*—whether it should belong to the physician or the surgeon. I must confess I fail to see where the difficulty arises. To my mind, it is impossible to conceive investigating any eye case, whether it be surgical or medical, without a knowledge of the refraction. It is as much a routine part of examining an eye as taking the tension, the pupil reaction, or the visual fields; and any ophthalmologist, whether physician or surgeon,

must be capable of doing the refraction and prescribing for its correction.

Refraction, too, might be raised to a higher status if it were studied from a medical standpoint. Our present empirical method of ordering glasses for treatment of headaches, with but scanty or no investigation of the cause of the headache, is not to our credit, and brings us into competition with the prescribing optician, who does but little less than we do.

There are often refractive problems depending on the physical condition, urgently requiring the investigation of the physician.

My suggestion of the means of bringing the physician into closer touch with ophthalmology by appointing him on the active staff of ophthalmic hospitals, may not be the best or simplest, but of the *need* of the physician there can be but little doubt, if any true advancement in our science is to be obtained.

Yours faithfully,

RAYNER D. BATTEN.

LONDON, W.

A METHOD OF IRIDOTOMY

To the Editor of the BRITISH JOURNAL OF OPHTHALMOLOGY.

SIR,—The method of iridectomy (not iridotomy) described by Mr. Mayou in the March number of the Journal was shown to me by the late Mr. Nettleship more than thirty years ago, and I have always assumed, though without any other evidence, that he had devised the operation. I have found this procedure very effective in cases (more common then than now) of updrawn iris after extraction of cataract.

I am, etc.,

J. B. LAWFORD.

NOTES

Deaths

WE regret to say that A. Reginald F. Evershed, of London, died from complications following influenza on January 25 last at Parkstone, aged 55. He joined his father, the late Dr. Arthur Evershed, at Hampstead, but soon started practice in Penzance. He then went to London, where he took up eye work. He was at first in the City and afterwards in Harley Street. He was oculist to the Cripples' Home, Winchmore Hill, to the Stock Exchange Benevolent Fund, and to the Brixton Dispensary. He was for many years

clinical assistant to the Royal Westminster Ophthalmic Hospital. In November, 1919, a breakdown in health necessitated his retirement from work. He was well known in the photographic world.

James Pinkerton, once surgeon to the Birkenhead Eye and Ear Hospital, died at West Kirby on February 16, 1920.

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Appointments

JAMES A. ROSS has been appointed consulting ophthalmologist to the Education Authority of Cumberland and consultant oculist to the Education Authority of Dumfriesshire. James Fison has been appointed assistant ophthalmic surgeon to Harrogate Infirmary.

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French Ophthalmological Society

THE next meeting of the French Society of Ophthalmology will take place on May 3, at 8.30 a.m., at 51, Rue de Clichy. Dr. Gonin, of Lausanne, will open a discussion dealing with the pathogeny and pathological anatomy of retinal detachment (excluding traumatic, neoplastic, and parasitical detachments).

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Council of British Ophthalmologists

A MEETING, which all British ophthalmic surgeons are invited to attend, will be held at 4 on Friday, April 30, at the rooms of the Royal Society of Medicine, 1, Wimpole Street, London, W., to receive a report of the work done by the Council of British Ophthalmologists.

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Oxford Ophthalmological Congress

THE Oxford Ophthalmological Congress will assemble at Keble College, Oxford, on the evening of Wednesday, July 14th next, and the meeting will be held on Thursday, the 15th, and Friday, the 16th. On the Thursday a discussion on "Perimetric Methods" will be opened by Dr. Luther C. Peter, of Philadelphia, Pa. The Doyne Memorial Lecture will be delivered on July 16 by Mr. F. Richardson Cross, the subject being "The Nerve Paths and Centres concerned with Sight." A General Meeting will be held during the Congress upon a time and day to be announced in the final programme. We understand that several distinguished foreign guests are expected to attend this meeting of the Congress. Further particulars may be obtained from the Secretary, Mr. Bernard Cridland, Salisbury House, Wolverhampton.